COMPARISON OF ANTIBIOTIC USAGE-THIRD GENERATION CEPHALOSPORIN SINGLE DOSAGE VS MULTIPLE DOSAGE IN CASE OF EMERGENCY OPEN UNCOMPLICATED APPENDICECTOMY

A DISSERTATION SUBMITTED TO

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

In partial fulfillment of the regulations for the award of the

M.S.DEGREE EXAMINATION

BRANCH I GENERAL SURGERY

DEPARTMENT OF GENERAL SURGERY

STANLEY MEDICAL COLLEGE AND HOSPITAL

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY
CHENNAI

` **APRIL 2015**

CERTIFICATE

This is to certify that the dissertation titled **"*COMPARISON OF ANTIBIOTIC USAGE-THIRD GENERATION CEPHALOSPORIN SINGLE DOSAGE VS MULTIPLE DOSAGE IN CASE OF EMERGENCY OPEN UNCOMPLICATED APPENDICECTOMY*"** is the bonafide work done by ***Dr. T.M.ARSHAD ALI*,** Post Graduate student (2012 – 2015) in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under my direct guidance and supervision, in partial fulfillment of the regulations of The Tamil Nadu Dr. M.G.R Medical University, Chennai for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2015.

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Place: Chennai.

Date: September 2014 **DR.T.M.ARSHAD ALI**

ACKNOWLEDGEMENT

My sincere thanks to **Dr.AL.MEENAKSHISUNDARAM, MD., D.A.,**The Dean, Govt. Stanley Medical College for permitting me to conduct the study and use the resources of the College.I consider it a privilege to have done this study under the supervision of my beloved Professor and Head of the Department **Prof.Dr.S.VISWNATHAN,** who has been a source of constant inspiration and encouragement to accomplish this work. I am highly indebted to my guide and Mentor **Prof. Dr.D.NAGARAJAN,** Professor of Surgery for his constant help, inspiration and valuable advice in preparing this dissertation.I express my deepest sense of thankfulness to my Assistant Professors **Dr.G.VENKATESH, Dr.S.JIM JEBAKUMAR, DR.MALARVIZHI** for their valuable inputs and constant encouragement without which this dissertation

could not have been completed.I express my sincere gratitude to my guides **Prof. Dr. P.Darwin, Prof.Dr.J.Vijayan, Prof. Dr.K. Kamaraj**, former Heads of Department of General Surgery and my former Professor, **Prof.Dr.A.Rajendran**. I thank them for the constant support, able guidance, inspiring words and valuable help they rendered to me during my course.

I would like to thank my former Assistant Professors **Dr.P.Balaji, Dr.G.V.Manoharan, and Dr.M.Vignesh,** for their valuable suggestions and help in completing this dissertation.

I am particularly thankful to my friends Dr.Dinesh, Dr.Kaushik Kumar, Dr.Aravind Menon, Dr.Prasanna, Dr.Sakthi Balan, Dr.Vinoth, Dr.Sukhdev, Dr.Madhuri

without whom accomplishing this task would have been impossible.I thank my Seniors Dr. Sudharsan, Dr. Naveen, Dr.Sivakumar, Dr.Saravana KrushnaRaja, Dr.N.SangaraNarayanan, Dr.Gautham Krishnamurthy and Dr.Soundarya.G for their valuable support in this study.

I am extremely thankful to my patients who consented and participated to make this study possible.

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INTRODUCTION

Acute Appendicitis is the most common general surgical emergency and early surgical intervention improves outcome which makes Appendicectomy , the most commonly performed emergency operation with a postoperative wound infection rate of 1-10% in the world.

Appendicitis is a polymicrobial infection,with some series reporting up to 14 different organisms cultured in patients with perforation.The principle organisms seen in normal appendix,in actue appendicitis,and in perforated appendicitis are Escherichia coli and Bacteriodes fragilis.

Most patients with acute appendicitis are managed by prompt surgical removal of the appendix. Wound infection following open appendicectomy is a major cause for post-operative morbidity,prolonged hospitalization and increased costs. The incidence of wound infection in patients with

complicated appendicitis (perforated or gangrenous appendix) is nearly four to five times greater than that of nonperforated cases.

The efficacy of antibiotic prophylaxis in reducing wound infection in patients undergoing open appendicectomy is well established. Many randomized and observational studies have shown that appropriate use of antibiotics reduces the risk of infection by 40–60%. Based on prospective clinical studies, guidelines have been established regarding the choice of prophylactic antibiotics, it's timing and route of administration. For emergency appendicetomy duration of antibiotic usage remains a contentious issue and there is no definite consensus among the surgical community

If simple acute appendicitis is encountered,there is no benefit in extending antibiotic coverage beyond 24 hrs.For intraabdominal infections of GI tract origin that are of mild to moderate severity,the Surgical Infection society has

recommended single-agent therapy with cefoxitin,cefotetan or ticarcillin-clavulanic acid.

But in daily practice multiple doses are used to prevent complications like wound infection and intra abdominal abscess.

Antibiotics should be administered 30 minutes prior to incision to achieve adequate tissue levels.In non-perforated appendicitis single preoperative dose of antibiotic suffices.In cases of perforation,an extended course of atleast 5 days of antibiotics is advocated.

This prospective study is designed to compare the outcome of usage of antibiotic single dose cefaperazone sulbactam vs multiple doses in cases of emergency open uncomplicated appendicectomy.

REVIEW OF LITERATURE

HISTORICAL BACKGROUND

Appendiceal disease is a frequent reason for emergency hospital admission, and appendectomy is one of the most common emergency procedures performed world wide.

Leonardo da Vinci first drawed the appendix but these was not published until the eighteenth century

Jean Fernel first described appendiceal disease in a paper published in 1544. Lorenz Heister provided the first description of classic appendicitis in 1711.

First known appendectomy was performed in 1736 by Claudius Amyand in London

In 1886, Reginald H. Fitz presented the findings of appendicitis and recommended operative treatment

In 1889, Charles McBurney published the indications for early laparotomy in appendicitis.

Embryology

Early in sixth week of intrauterine life,a small diverticulum appears on caudal limb of midgut loop and this later differentiates in to caecum and vermiform appendix.Until the fifth month,the diverticulum has a conical outline,but later on,its distal part remains rudimentary and forms the vermiform appendix,while its proximal part expands to form caecum.

At birth,the vermiform appendix extends from the apex of caecum.Owing to unequal growth of the walls of the caecum,it subsequently comes to lie on the medial side of caecum.

In certain conditions like midgut malrotation and situs inversus, the caecum (and thus the appendix) will not be in the right iliac fossa

In mid gut malrotation appendix lie in the left chondrium where as in situs inversus appendix lie in the left iliac fossa.

Anatomy

Vermiform appendix is a narrow,worm shaped tube, which springs from the posteromedial wall of the caecum,2 cm or less,below the end of the ileum.In adult average length of the appendix is 6 to 9cm.it can vary from 1 to 30 cm. The outer diameter varies from 3 to 8 mm, luminal diameter 1 to 3 mm.It is longer in children than in adults.Its position may vary and is named according to positions.

Positions:

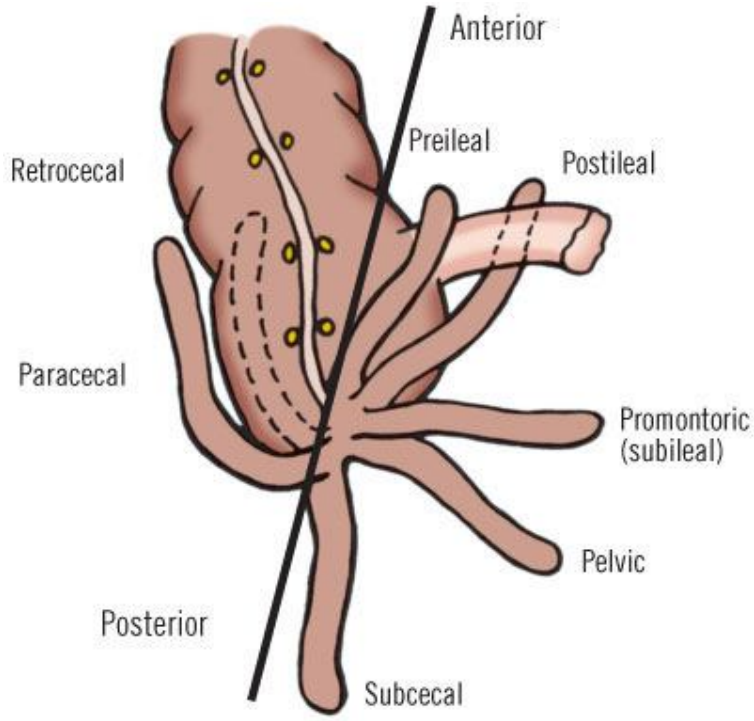
I. Retrocaecal/Retrocolic - 74%

II. Pelvic - 21%

III.Subcaecal - 1.5%

IV. Preileal - 1%

V. Postileal - 0.5%

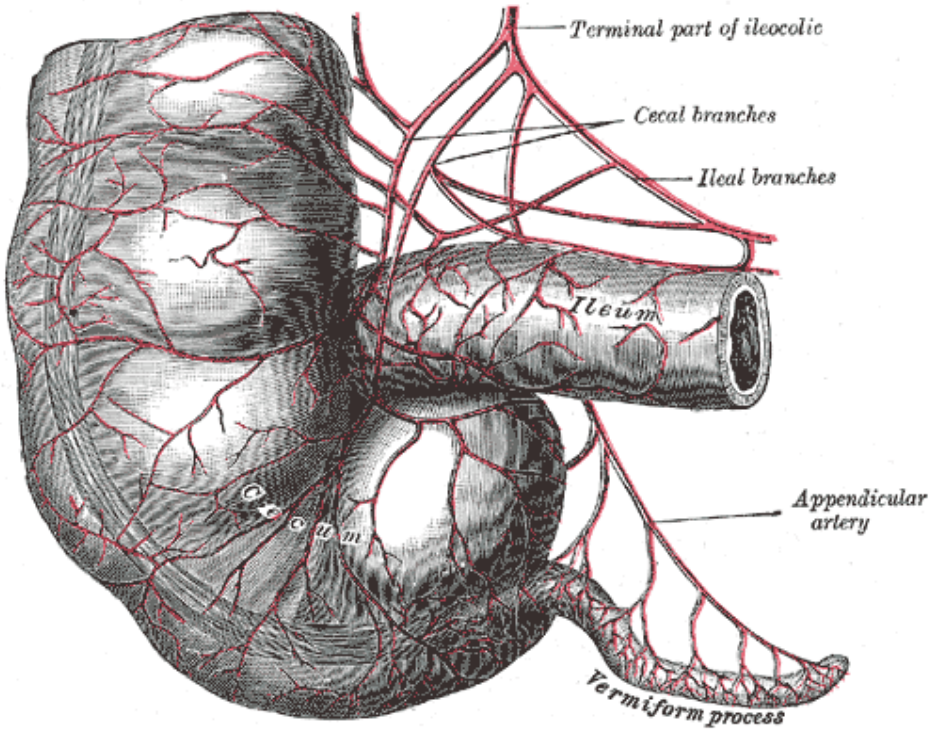


The surface marking most often used for the base of the appendix is the junction of the lateral and middle thirds of the line joining the right anterior superior iliac spine to the umbilicus popularly known as McBurney's point.

The three taeniae coli on the ascending colon and caecum converge on the base of the appendix,where they merge in to its longitudinal muscle layer.The anterior taeniae(Taeniae libra) of

the caecum,which is generally distinct and can be easily traced to the root of the appendix,is used as a guide.

The appendix is connected by a short mesoappendix to the lower part of the mesenrery of the ileum.Mesoappendix contains the main appendicular artery,which is a branch of the lower division of ileo-colic artery.Appendicular artery enters the mesoappendix a short distance from the base of the appendix with a branch of the posterior caecal artery.This arterial supply of the appendix may vary considerably.Acessory arteries are common.In 80 % of subjects there are two or more accessory arteries.This is known as Dr.Sheshachalam's artery.This has got applied importance during appendicectomy.



Anatomical considerations considering to appendicitis:

Appendix is a susceptible site for inflammation and infection because

-It is long tube like,with a narrow lumen

-It is cul-de –sac(one end is blind)

-Rich in lymphoid tissue (known as abdominal tonsil)

-Positional variations

-Has got false valve of Gerlach

-Appendicular artery is an end artery

-Near to caecum,which is rich in all microorganisms

MICROSCOPIC ANATOMY:

The lumen of the appendix is irregular,being encroached upon by multiple lngngitudinal folds of mucous membrane lined by columnar cell intestinal mucosa of colonic type.Crypts are present but are not numerous.In the base of the crypts lie the argentaffin cells (Kulschisky cells) which may give rise to carcinoid tumours.The submucosa contains numeruous lymphatic aggregations of follicles.

VENOUS DRAINAGE:

Drained by branches of the ileocolic vein drain the appendiceal venous network in to the superior mesenteric vein which in turn drains in to the portal system.

LYMPHATIC DRAINAGE:

Lymphatic vessels pass to the lymph nodes in the mesentery of the appendix and those that lie along the ileocolic artery.

NERVE SUPPLY:

Nerves are derived from the vagus (parasympathetic nerves) and from superior mesenteric ganglia and celiac ganglia (sympathetic nerves).The nerves are distributed in plexus around ramification of superior mesenteric artery.

HISTOLOGY

The appendix has the same four layers as the remainder of the gut.Mucosa,submucosa,muscularis propria and serosa.

Mucosa

Single layer of surface epithelial cells including columnar cells with basally located nuclei,goblet cells,apical mucin and absorptive cells.The Lamina propria is moderately cellular and

contain crypts of Lieberkunn which are contiguous with the surface epithelium.There are also prominent lymphoid follicles with germinal centers.

Sub-mucosa

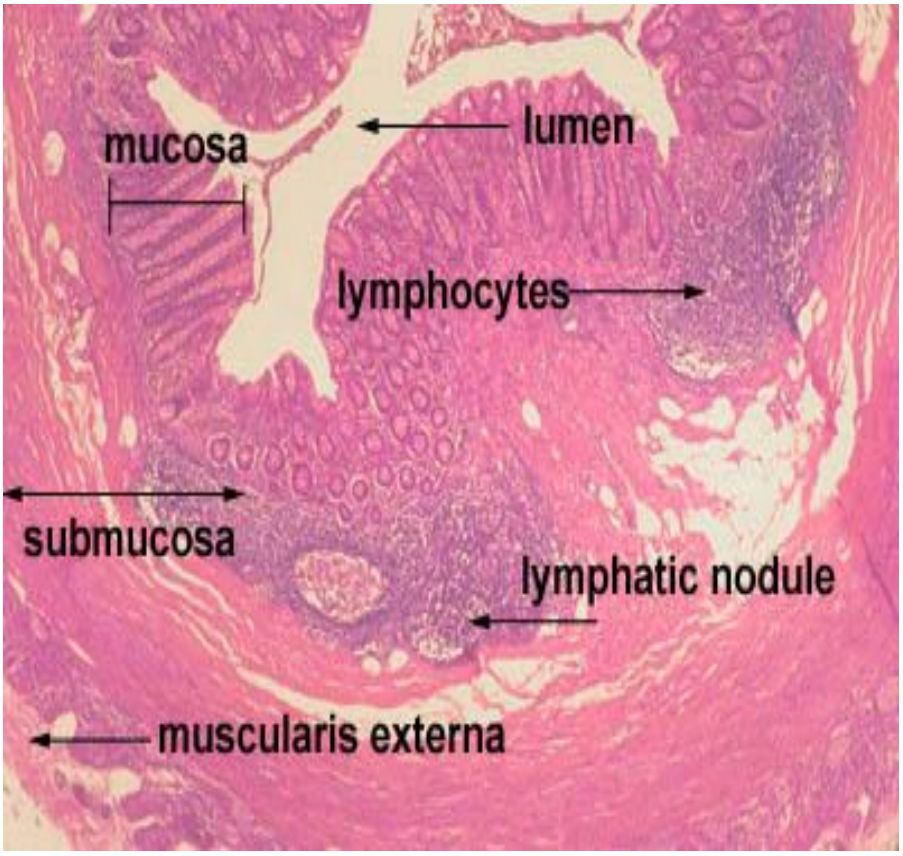
Contains a rich network of arterioles,venules,capillaries and lymphatics in a connective tissue framework.The meissner's plexus found in sub mucos,and consists of collections of ganglion cells and associated neuronal Schwann cells.

Muscularis propria

Consists of an inner circular layer and an outer longitudinal layer of smooth muscle between these two muscle band lies Auerbach's plexus.

Serosa

Consists of a slender band of fibrous tissue over which lies a signle layer of cuboidal epithelial cells.



PHYSIOLGY

It was thought that appendix is an vestigeaal organ with no function.It is proved that appendix function as an immunologic organ and secrete immunoglobulins,especially immunoglobulin A.Secretory immunoglobuins produced by Gut lymphoid tissue(GALT) function as a very effective barrier that

protects milieu interior against the hostile milieu exterior.Removal of the appendix produces no detectable change in human function. Patients who underwent appendectomy before the age of 20 years has less chance of developing ulcerative colitis.

ACUTE APPENDICITIS

Acute appendicitis is one of the most common causes of an abdominal emergency and accounts for approximately 1% of all surgical operations. Although rare in infants, appendicitis becomes increasingly common throughout childhood and reaches its maximal incidence between the ages of 10 and 30 years. After 30 years of age, the incidence declines, but appendicitis can occur in individuals of any age.

Among teenagers and young adults, the male-to-female ratio is about 3:2. After age 25 years, the ratio gradually declines until the sex ratio is equal by the mid-30s.

PATHOPHYSIOLOGY

The most commonly accepted theory of the pathogenesis of appendicitis is that it results from obstruction followed by infection.The lumen of the appendix becomes obstructed by hyperplasia of submucosal lymphoid follicles, a fecalith, tumor, or other pathologic condition.

In simple acute appendicitis faceoliths and calculi are found in 40 % of patients,in gangrenous appendicitis without rupture and in gangrenous appendicitis with rupture faecoliths and calculi are found in 65 % and 90 % respectively.

Once the lumen of the appendix is obstructed, the sequence of events leading to acute appendicitis is probably as follows:

Mucus accumulates within the lumen of the appendix, and pressure within the organ increases.

Virulent bacteria convert the accumulated mucus into pus. Continued secretion combined with the relative inelasticity of the serosa leads to a further rise in pressure within the lumen.

This results in obstruction of the lymphatic drainage, leading to edema of the appendix, diapedesis of bacteria, and the appearance of mucosal ulcers. At this stage, the disease is still localized to the appendix; therefore, the pain perceived by the patient is visceral and is localized to the epigastrium or periumbilical area.

Continued secretion into the lumen and increasing edema bring about a further rise in intraluminal and tissue pressure, resulting in venous obstruction and ischemia of the appendix.

Bacteria spread into and through the wall of the appendix, and acute suppurative appendicitis ensues.(1,2)

Somatic pain occurs when the inflamed serosa of the appendix comes in contact with the parietal peritoneum and results in the classic shift of pain to the right lower quadrant.

As this pathologic process continues, venous and arterial thromboses occur in the wall of the appendix, resulting in gangrenous appendicitis. At this stage, small infarcts occur,

permitting escape of bacteria and contamination of the peritoneal cavity.

The final stage in the progression of acute appendicitis is perforation through a gangrenous infarct and the spilling of accumulated pus. Perforating appendicitis is now present, and morbidity and mortality increase.(3)

Microbiology

The microbes of the normal appendix differs from that of inflammed appendix. About 60% of aspirates of inflamed appendices have anaerobes when compared to 25% of aspirates from normal appendix. Tissue culture from the inflamed appendix wall show growth of *Escherichia coli* and *Bacteroides* species. *Fusobacterium nucleatum/necrophorum*,Microbes which are not present in the normal cecal flora are identified in 62% of inflamed appendix like Fusobacterium nucleatum /necrophorum. In addition to the other usual microbes (*Peptostreptococcus*,*Pseudomonas*, *Bacteroides splanchnicus*, *Bacteroides intermedius*, *Lactobacillus*), previously unreported

fastidious gram-negative anaerobic bacilli have been identified. Bacteriodes found to have tissue invasion in patients with gangrenous or perforated appendicitis.(42)

CLINICAL DIAGNOSIS

The application of clinical skills by the surgeon is ut most important in the diagnosis of acute appendicitis.The clinical diagnosis starts from asking the proper history. The history usually begins with abdominal pain often localized to the epigastrium or the periumbilical area, followed by anorexia and nausea.

Vomiting, if it occurs,appears next. After a variable period, usually about 8 hours, the pain shifts to the right side and usually into the right lower quadrant. At the time of presentation, the duration of pain is less than 24 hours in 75% of patients.

Sequence of events:

The sequence of events in acute appendicitis is usually characteristic and follow like this-

It usually starts with diffuse pain,followed by anorexia,nausea and vomiting .Later the pain shifts to right side of the abdomen accompanied by a slight rise in body temperature.This is known as Murphy's syndrome(triad).

Visceral pain

This is steady sometimes intermittent cramping and usually lasts for 4-6 hours.This pain is felt around the umbilicus,in the epigastrium or it may by generalised.It is due to distension of the appendix and irritation of visceral peritoneum and hence it is vague.

Somatic pain

The parietal peritoneum in right lower quadrant gets irritated by progressive inflammation of the appendix causing constant,more intense and localised somatic pain that begun to

predominate.Patient often report this is an abdominal pain that has shifted and changed in character.

Atypical pain

In elderly patients atypical presentations is most oftenly seen.Shifting of pain from periumbilical region to the right iliac fossa is mostly not seen.If the inflamed appendix is in the pelvic position,it may not cause somatic pain rather may produce suprapubic discomfort and tenesmus.In this situations tenderness may be elicited only by rectal examination and is the basis for rectal examination which should be performed on every patient presenting with acute lower abdominal pain.

Anorexia

It is constant and useful clinical feature,especially in children.

Nausea

Nausea of some degree is present in 9 out of 10 patients with appendicitis.

Vomiting

This varies,depending on the age.Frequent in children and teenagers,it may be absent in older adults. Vomiting occurs in less than 50% of patients.

The presence or absence of vomiting is not a criterion for the diagnosis of appendicitis. When vomiting does occur, it is usually not persistent, and most patients vomit only once or twice. If vomiting occurs, it occurs *after* the onset of pain with such regularity that if it precedes pain, the diagnosis of appendicitis should be questioned.

Change in bowel and bladder habits

Change in bowel will retrieve their abdominal pain.Diarrhoea occurs in some,especially in children,probably due to proximity of the inflamed appendix to ileum,rectum or sigmoid colon.

Urinay frequency and dysuria occur if the appendix lies adjacent to the bladder.

PHYSICAL EXAMINATION

Appearance

Patient is usually flushed and in obvious pain

Posture

The patient prefers to lie supine,with the thighs,partly flexed especially right side because even minimal movement increases the pain due to irritation of the parietal peritoneum.Patient usually walks slowly.

Tongue

Initially furred,progressively gets coated and the breath becomes foul.

Temperature

Rarely rises above 38 degree Celsius in uncomplicated appendicitis.tempetature above 38 degree Celsius should always suggest the presence of perforation and peritonitis or other disease should be considered.

Pulse rate

This will be normal or slightly elevated,especially in complicated appendicitis.

Tenderness,Muscle guarding and rigidity

There cannot be acute appendicitis without tenderness,which may be mild and diffuse in the early stages of the disease,later on localisation according to the position of the appendix

On routine abdominal examination, an area of maximal tenderness often is elicited in the area of McBurney's point, which is located two thirds of the distance along a line from the umbilicus to the right anterior superior iliac spine.

If the appendix is in a high retrocecal position or is entirely within the true pelvis, point tenderness and muscle rigidity might not be elicited.

In high retrocecal appendicitis, tenderness may occur over a large area, and there may be no signs of muscle rigidity.

In pelvic appendicitis, neither tenderness nor muscle guarding may be present. Both signs are often lacking or only minimally expressed in the aged population.

Cutaneous hyperesthesia

Over the area supplied by spinal nerves T10,T11,T12 on the right is a frequent,but not constant component of appendicitis.

Rebound tenderness

It is elicited by the sudden release of abdominal palpation pressure

Pointing sign

The patient is asked to point to where the pain begin and where it is moved.

Rovsing's sign

Deep palpation of the left iliac fossa may cause pain in the right iliac fossa.

Psoas sign

The right hip is often kept in slight flexion to keep the iliopsoas muscle relaxed. Stretching the muscle by extension of the hip or further flexion against resistance can initiate a positive psoas sign, indicating irritation of the muscle by an inflamed appendix. A psoas sign is seldom seen in early appendicitis and can be elicited in patients without any pathologic condition.

Obturator sign

If an inflamed appendix is in contact with obturator internus,flexion and internal rotation of right hip joint ,will cause pain in the hypogastrium

Baldwin's sign

This test is to detect retrocaecal appendicitis.While maintaining finger tip pressure over the right flank,the patient asked to raise the lower limb off the bed,keeping the knee extended.The test is positive if patient complains of pain or drops the limb with an expression of agony on the face.

Dunphy sign

When the patient is asked to cough,the pain gets aggravated.

Mc fadden's sign

Child postpones micturition in fear of pain.

Shake test

This is done by grasping the iliac wings and shaking the pelvis side to side.patient compalains of pain in localised peritonitis

Abdominal Mass

As the disease process progresses, it may be possible to palpate a tender mass in the right lower quadrant. Although the mass may be caused by an abscess, it can also result from adherence of the omentum and loops of intestine to an inflamed appendix.

When appendicitis becomes advanced enough that there is a large, inflamed mass and the anterior abdominal wall is

involved, the patient often avoids sudden movements that can cause pain.

Rectal examination

It is indicated primarily to exclude lesions such as ovarian cyst or tubal patholol gy in females and to elicit tenderness in cases of pelvic appendicitis.Rectal examination is of little value in establishing the diagnosis of acute appendicitis but can be useful to determine the presence or absence of a mass

If the appendix ruptures, the physical examination will change. If the infection is contained, a tender mass will often develop in the right lower quadrant, and the area of tenderness will now encompass the entire right lower quadrant.

Involuntary guarding becomes evident and rebound tenderness more marked. The patient's temperature will be more like that seen with abscess formation and may rise to 39° C with a corresponding tachycardia.

If appendiceal rupture fails to localize, signs and symptoms of diffuse peritonitis will develop. Tenderness and

guarding become generalized, the temperature remains higher than 38° C with spikes to 40° C, and the pulse rate increases to more than 100 beats/min.

ACUTE APPENDICITIS IN INFANTS AND YOUNG CHILDREN

The diagnosis of acute appendicitis is difficult in infants and young children for many reasons. The patient is unable to give an accurate history, and although appendicitis is infrequent, acute nonspecific abdominal pain is common in infants and children. Because of such factors, the diagnosis and treatment are often delayed, and complications develop.

The clinical presentation of appendicitis in children can be quite similar to nonspecific gastroenteritis; thus, the suspicion of appendicitis often is not entertained until the appendix has ruptured and the child is obviously ill.(18)

Two thirds of young children with appendicitis have had symptoms for more than 3 days before appendectomy. Because children often cannot give an accurate history of their pain, the

physical examination and other aspects of the history must be relied on to make the diagnosis.(19)

Vomiting, fever, irritability, flexing of the thighs, and diarrhea are likely early complaints. Abdominal distention is the most consistent physical finding. As in adults, the total leukocyte count is not a reliable test.

The incidence of perforation in infants younger than 1 year of age is almost 100%, and although it decreases with age, it is still 50% at 5 years of age. The mortality rate in this age group remains as high as 5%.

In one series, nearly 40% of children with complicated appendicitis had been seen previously by a physician who failed to make the diagnosis of appendicitis.[20]

APPENDICITIS IN YOUNG WOMEN

Although the overall incidence of negative laparotomy in patients suspected of having appendicitis is as high as 20%, the incidence in women younger than 30 years of age is as high as 45%.(39)

Pain associated with ovulation; diseases of the ovaries, fallopian tubes, and uterus; and urinary tract infections (cystitis) account for most of the misdiagnoses.(43)

If a young woman has atypical pain; no muscular guarding in the right lower quadrant; and no fever, leukocytosis, or leftward shift in the differential WBC count, it is best to observe the patient with frequent re-examinations. If after several hours the patient's signs and symptoms remain stable, it is appropriate to perform a CT scan.(24)

APPENDICITIS DURING PREGNANCY

The risk of appendicitis during pregnancy is the same as it is in nonpregnant women of the same age; the incidence is 1 in 2000 pregnancies.(21)

Appendicitis occurs more frequently during the first two trimesters, and during this period the symptoms of appendicitis are similar to those seen in nonpregnant women.

Surgery should be performed during pregnancy when appendicitis is suspected, just as it would be in a nonpregnant

woman. As in the nonpregnant patient, the effects of a laparotomy that produces no findings are minor, whereas the effects of ruptured appendicitis can be catastrophic.

Recent studies indicate that there is no increase in morbidity and mortality with laparoscopic appendectomy versus open appendectomy for the patient or the fetus.

During the third trimester of pregnancy, the cecum and appendix are displaced laterally and are rotated by the enlarged uterus. This results in localization of pain either more cephalad or laterally in the flank, leading to delay in diagnosis and an increased incidence of perforation.

Factors such as displacement of the omentum by the uterus also impair localization of the inflamed appendix and result in diffuse peritonitis.

In cases of uncomplicated appendicitis, the prognosis for the infant following appendectomy is directly related to the infant's birth weight. If peritonitis and sepsis ensue, infant

mortality increases because of prematurity and the effects of sepsis.

Acute appendicitis can be confused with pyelitis and torsion of an ovarian cyst. However, death from appendicitis during pregnancy is mainly caused by a delay in diagnosis.

In the final analysis, early appendectomy is the appropriate therapy in suspected appendicitis during all stages of pregnancy.

APPENDICITIS IN THE ELDERLY POPULATION

Appendicitis has a much greater mortality rate among elderly persons when compared with young adults. The increased risk of mortality appears to result from both delay in seeking medical care and delay in making the diagnosis.(22)

The presence of other diseases associated with aging contributes to mortality, but the major reason for the increased mortality of appendicitis in the aged is delay in treatment.

Classic symptoms are present in elderly persons but are often less pronounced. Right lower quadrant pain localizes later and may be milder in elderly persons.

On initial physical examination, the findings are often minimal, although right lower quadrant tenderness will eventually be present in most patients. Distention of the abdomen and a clinical picture suggesting small bowel obstruction are commonly seen.

More than 30% of elderly patients will have a ruptured appendix at the time of operation. Although other factors play a role, delay in seeking care and in making the diagnosis are the major reasons for perforation.

It is imperative, therefore, that once the diagnosis of acute appendicitis is made, an urgent operation must be advised.

COMPLICATIONS OF ACUTE APPENDICITIS

I.Perforation and its consequences

II.Abscess formation and its complications

-Appenduculo cutaneous fistula

-Appendico vesical fistula

III.Diffuse peritonitis

-due to contamination of peritoneal cavity before defensive adhesion formation

-secondary rupture of intra abdominal abscesses that were produced by ruptured appendicitis.

PERFORATION

A serious complication of appendicitis,that results from a delay in diagnosis and surgical treatment. Unfortunately ,this is not an uncommon complication and occurs in 19-32% of patients undergoing surgery for appendicitis.

62% of patients with perforation had been symptomatic for more than 24 hours,in contrast to 33% of those without perforation.This explains that delay in seeking medical attention,is probably most important factor leading to perforation.

Silberman emphasized on the delay from the time of admission to that of surgery.79 % patients with perforation

underwent operation within 6 hours of admission and 93 % within 12 hours.

Perforation should be suspected when the duration of symptoms exceeds 24 hours,the temperature is more than 38 degree Celsius and WBC count more than 15,000 cells/cu.mm.These are uncommon findings in non perforated appendicitis.

If the perforation has been walled off in to an appendiceal abscess,a tender mass can often be palpated in the right lower quadrant.If discomfort makes palpation of the right lower quadrant difficult,it is helpful to examine the partient under anaesthesia befor the incision is made.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of abdominal pain is a stimulating exercise. When the classic symptoms of appendicitis are present, the diagnosis of appendicitis is usually easily made and is seldom missed.

When the diagnosis is not obvious, knowledge of the differential diagnosis becomes important. Most of the entities in the differential diagnosis of appendicitis also require operative therapy or are usually not made worse by an exploratory laparotomy.

Therefore, it is essential that one eliminate those diseases that do not require operative therapy and can be made worse by operation, such as pancreatitis, myocardial infarction, and basilar pneumonia.

The diseases in young children that are most frequently mistaken for acute appendicitis are

- gastroenteritis
- mesenteric lymphadenitis
- Meckel's diverticulum
- pyelitis
- small intestinal intussusceptions
- enteric duplication
- basilar pneumonia.

In mesenteric lymphadenitis, an upper respiratory infection is often present or has recently subsided.

Acute gastroenteritis is usually associated with crampy abdominal pain and watery diarrhea.

Intestinal intussusception occurs most frequently in children younger than 2 years of age, an age at which appendicitis is uncommon. With intussusception, a sausage-shaped mass is frequently palpable in the right lower quadrant. The preferred diagnostic procedure is a gentle BE, which, in addition to making the diagnosis, usually reduces the intussusception.

In teenagers and young adults, the differential diagnosis is different in men and women. In young women, the differential diagnosis includes

-ruptured ectopic pregnancy

- mittelschmerz

- endometriosis

- salpingitis

- Chronic constipation

The symptoms that accompany the acute onset of regional enteritis can mimic acute appendicitis, but a history of cramps and diarrhea and the lack of an appropriate history for appendicitis are hints that the diagnosis is regional enteritis.

In young men, the potential list of differential diagnoses is smaller and includes the

-acute onset of regional enteritis

- right-sided renal or ureteral calculus

- torsion of the testes

- acute epididymitis.

In older patients, the differential diagnosis of acute appendicitis includes

-diverticulitis

- perforated peptic ulcer

- acute cholecystitis

- acute pancreatitis

- intestinal obstruction

- perforated cecal carcinoma

- mesenteric vascular occlusion

-rupturing aortic aneurysm

and the disease entities already mentioned for young adults.

LABORATORY INVESTIGATIONS AND SCORING

This is very much true of acute appendicitis,as only laboratory investigations,without any clinical backgrounds donot establish diagnosis.

1.Total WBC count and differential count

In the early diagnosis of acute appendicitis, laboratory tests are of little value. Up to one third of patients, particularly older patients have a normal total leukocyte count with acute appendicitis, and more than half have, at most, a mild elevation.

Even when the total leukocyte count and the differential white blood cell (WBC) count are abnormal, the degree of

abnormality does not correlate well with the degree of appendiceal inflammation.

Even when the total WBC count is normal, the differential WBC count often reveals a shift to the left with an increase in the percentage of polymorphonuclear neutrophils. Less than 4% of patients have both a normal total WBC count and a normal differential count.

The most important fact to remember when considering the diagnosis of appendicitis is that the clinical findings take precedence over the WBC count when they are at variance.

Moderate leucocytosis,ranging from about 10,000-18,000 cells/cumm,with neutrophilia,is the common picture in acute appendicitis.

With normal counts and diffential counts,the diagnosis of acute appendicitis is still a possibility.If the WBC count is more than 18,000 cells/cu.mm and shift to the left is extreme,perforated appendicitis or an acute inflammatory

disease of a greater magnitude than appendicitis is more possible.(4,5,6)

SCORING SYSTEMS

1.Alvarado score :

The classical signs and symptoms of acute appendicitis were first reported by Fitz in 1886.The Alvardo score was described in 1986 and has been validated in adult surgical practice.The classical Alvardo score included left shift of neutrophil maturation yielding a total score of 10.

ALVARADO (MANTREL'S) SCORE

SYMPTOMS	**MIGRATORY RIF PAIN**	**1**
	ANOREXIA	**1**
	NAUSEA AND VOMITING	**1**
SIGNS	**TENDERNESS RIF**	**2**
	REBOUND TENDERNESS	**1**
	ELEVATED TEMPERATURE	**1**
LAB INV	**LEUCOCYTOSIS**	**2**
	SHIFT TO LEFT	**1**
	TOTAL	**10**

2.Modified Alvardo score

Kalan et omitted the left shift of neutrophil maturation parameter and produced a modified score.The modified Alvardo score yields a total of 9.Patients with a score of 1-4 are considered unlikely to have acute appendicitis.Patients with a score of 5-6 have possible diagnosis of acute appendicitis,not convincing to have enough surgery.Those with a score of 7-9 are regarded as patients with acute appendicitis.

3.Teicher scoring system

Teicher et al described a scoring system,after retrospectively studying 100 cases of acute appendicitis.

A score greater than 3 was taken as a positive predictor of acute appendicitis.This system if applied,would have prevented negative laparotomies in 38 % of the patients and 5 % would have been kept for observation.

TEICHER SCORING SYSTEM

SCORE	POSITIVE PREDICTORS	NEGATIVE PREDICTORS	SCORE
+2	MALE	FEMALE	-1
+3	AGE>50	20-39 YRS	-1
+2	DURATION 1/2 DAY	DURATION >3 DAYS	-3
+1	DURATION 2 DAYS	GENITOURINARY SYMPTOMS	-3
+3	INVOLUNTARY RIGHT LOWER QUADRANT SPASM	NO SPASM RECTAL MASS RT SIDE TC>10,000 CELLS/CU.MM	-3

IMAGING MODALITIES

RADIOGRAPHIC EXAMINATION

With rare exceptions, plain roentgenologic examination of the abdomen is of little help in the differential diagnosis of acute appendicitis.

The exceptions are when a fecalith is demonstrated and when other diagnoses such as acute cholecystitis, perforating duodenal ulcer, perforating colon cancer, acute diverticulitis, and pyelonephritis are being excluded.

It is not unusual to see cecal distention or a sentinel loop of distended small intestine in the right lower quadrant in patients with acute appendicitis. In late appendicitis with perforation and abscess formation, a mass can often be demonstrated that is extrinsic to the cecum.

There may be scoliosis to the right, lack of the right psoas shadow, lack of small bowel gas in the right lower quadrant with abundant gas elsewhere in the small bowel, and signs of edema of the abdominal wall.

With late appendicitis and generalized peritonitis, there is an ileus pattern with generalized gas throughout the small and large intestine.

Plain radiography has been used in the diagnosis of appendicitis since 1906.However,it lacks specificity.

Signs in plain x-ray abdomen

1.localised ileus with gas filled caecum.

2.Fluid levels in caecum

3.Increased soft tissue density in the right lower quadrant

4.Blurring of right flank stripe-the radiolucent line produced by fat beween the peritoneum and transverse abdominal line.

5.Faecolith in the RIF

6.Blurring of ritht psoas shadow

7.Free intra peritoneal air

8.Deformity of caecal gas shadow owing to adjacent inflammatory mass.

BARIUM ENEMA(7,8)

Barium enema (BE) examination was recommended in the past in young women in whom the diagnosis was still in question after hours of observation and in patients with a debilitating systemic disease, such as leukemia, in whom the operative risk is markedly increased. The findings of significance on BE include lack of filling or partial filling of the appendix and an extrinsic pressure defect on the cecum (the "reverse 3" sign).

ULTRA SOUND

Ultra sonography is often used as the initial diagnostic imaging study in the majority of patients in whom the clinical diagnosis of appendicitis is equivocal.Ultrasound is non invasive and rapidly available and avoids radiation exposure.

Deutsch et al was the first to report ultrasonic visualization of an inflamed appendix in 1981,in a child suffering from acute leukemia.

Abdominal ultrasound examination is more useful in children and in thin adults,particularly if gynaecologic pathology is suspected,with a diagnostic accuracy in excess of 90%

Jefrey et al studied 250 cases of acute appendicitis and laid down sonographic criteria for diagnosis.

Currently diagnosis criteria used for the diagnosis of acute appendicitis by ultrasound are:

1.Blind ending,immobile,non-compressible,aperistaltic,tubular structure.Mural thickness is assessed by measuring the

distance from the echogenic mucosa to the outer edematous wall that shows few echoes.

2.Cannot be displaced on pressure

3.Bull's eye or target lesion visualised in the transverse plane with diameter > 6mm.

4.Faecolith in the lumen

5.Periappendiceal collection

6.Hypo or hyperperistaltic loops in the right iliac fossa

7.Miscellaneous signs:

'Cockade' around target lesion.Tubular structure > 50 mm in length.(9,10)

Graded compression ultrasonography performed in 139 patients,the sensitivity and specificity of ultrasonography for diagnosing appendicitis was 95 % and 89 % respectively.

Jeffrey et al in a study pointed out the sonographic pitfalls in the diagnosis of acute appendicitis,in which observed that a dilated fallopian tube or hypertrophied fibres of the psoas

muscle could be mistaken for a target lesion,while a gas containing appendix could be mistaken for a bowel loop.(11,12)

Conclusion

Ultrasound is highly specific for the diagnosis of appendicitis in the hands of experts and also has the advantage of non invasively excluding diseases which do not require surgical intervention like ureteric colic or gynaecological disorders.

It is non invasive and can also be used safely in pregnant patients and children with no radiation hazard.

COLOUR DOPPLER

Color Doppler examination is based on the principle that acute inflammation of the appendix is associated with increased blood flow to the region.

Quillin et al in 1992,imaged 100 children concurrently with colour Doppler and gray scale ultrasonography,and found a sensitivity of 87 % and a specificity of 97 % with an accuracy of 90 % by gray scale ultrasonography.

A finding of increased vascularity was considered positive for appendicitis and a hyperaemic right lower quadrant mass suggestive of an abscess.

COMPUTERISED TOMOGRAPHIC SCANNING

Studies that compared Ultra sound and CT have demonstrated CT to be more accurate than Ultra sound in the diagnosis of appendicitis in clinically equivocal cases.

Therefore, Ultra sound should be used only when an experienced radiologist with an interest in appendicitis is available.

Although more expensive, CT has also been demonstrated to be of benefit in the diagnosis of acute appendicitis and has an accuracy of greater than 94%.(13)

The cost can be reduced with no significant loss in diagnostic accuracy by performing a limited, unenhanced CT.

Appendicitis is diagnosed when the appendix is thickened with a diameter greater than 6 mm; a phlegmon, fluid, or abscess is present; there is an appendolith; and there are

inflammatory changes in the periappendiceal fat (streaking and poorly defined increased attenuation).(14,15)

The presence of pericecal inflammation without the presence of an inflamed appendix or an appendolith without the presence of periappendiceal inflammation are both insufficient to diagnose acute appendicitis.

Contrast enhanced CT scan is most useful in patients in whom there is diagnostic uncertainity,particularly older patients,in whom acute diverticulitis,intestinal obstruction or neoplasm are likely diffential diagnosis.

Intravenous contrast helps to highlight inflammation around the appendix.Selective use of CT scanning may be cost effective by reducing both the negative appendicectomy and lenth of hospital stay.

Enhanced CT scan is a good imaging diagnostic tool for suspected appendicitis,having sensitivity of 87 % and specificity of 86 %

Improved image resolution to the 0.5 cm to 1.0 cm range has improved the accuracy of CT scanning.In the abscence of signs of inflammation,the diagnosis is less certain and in this situation a CT scan might be of value.(16)

In a study of 38 patients,Gale at found that CT scan had a sensitivity of 92 % and a specificity of 79 %.They described the common findings in acute appendicitis on CT as

a.Peri-caecal inflammation (68 %)

b.Abscess formation (55 %)

c.Calcified appendicolith (23%)

d.Abnormal appendix (18 %)

The accuracy of CT is greatest when a deliberate effort is made to visualize the appendix.CT is used in conjunction with repetitive examination and clinical observation in patients with equivocal findings,high risk population for false positive examination .

Using this approach,the frequency of negative explorations has been significantly reduced.

MISCELLANEOUS INVESTIGATIONS:

URINE EXAMINATION:

Urinalysis is helpful in the differential diagnosis of patients with lower abdominal pain only when it reveals significant numbers of red blood cells, WBCs, or bacteria. Minimal numbers of red blood cells, WBCs, and bacteria are seen in normal patients as well as in patients with appendicitis.

The presence of hematuria or pus cells in the urine does not rule out appendicitis. Irritation of ureter or urinary bladder by the inflamed appendix may cause microscopic hematuria or pyuria.

Graham(1965) quantitatively analysed midstream urine specimens in 71 patients operated upon with the diagnosis of acute appendicitis. Of these, 62 had an acutely inflamed appendix removed and nine patients had normal appendix. In this whole group, nine female patients had microscopic pyuria and one also had hematuria. One male patient had microscopic hematuria.

LIVER FUNCTION TEST

Patients with advanced appendicitis and abscess formation or generalized peritonitis may have abnormalities in liver function tests that mimic obstructive jaundice, biliary stasis, or other primary liver problems.

C-REACTIVE PROTEIN

CRP is a non specific acute phase reactant, which appears in the serum of individuals in response to a variety of inflammatory conditions and tissue necrosis.

It is a non-specific indicator for acute appendicitis. There have been various studies regarding the importance of CRP in differentiating appendicitis from other non inflammatory conditions of the abdomen.

One of the such studies showed that CRP value is increased markedly only after appendiceal perforation or abscess formation.

However increase in leukocyte count was found to be an early marker of appendiceal inflammation. This study reported that

the CRP concentration and temperature had high power in discrimating advanced appendicitis than all appendicitis. Also the CRP concentration >10mg/L was found to be one of the independent predictors of appendicitis.

CRP estimation required specialized laboratory equipment,which has now been resolved by using CRP kits.

Conclusion:

CRP is elevated in any cause of acute inflammation.But if clinical suspicion of appendicitis is not confirmed,CRP estimation provides the clue for acute appendicitis

CLINICAL OUTCOME FOR APPENDICITIS

1. Resolution
2. Gangrenous appendicitis
3. Perforation leading to generalized peritonitis
4. Appendicular mass or abscess formation
5. Fibrosis

TREATMENT

Patients with acute,non perforated appendicitis should undergo urgent appendicectomy.There have been few studies examining the role of antibiotic therapy alone for appendicitis.

Errikson and Granstrom performed randomised trial of antibiotic therapy versus surgical therapy for patients with appendicitis.In a small number of patients,the initial success was 85 % but recurrence rate of 35 % with short follow up.Owing to high recurrence rate,the current standard is operative treatment.

The answer for treatment of acute appendicitis and its complications,is SURGERY,and the only dilemma it carries with it is the timing of surgical intervention.

There has been a difference of opinion however concerning the optimal timing for ruptured appendicitis with frank periappendiceal abscess formation.Expectant treatment was advocated by A.T.OCSHNER in 1901.If progression occurs,the abscess is drained. If the patient improves, conservative treatment is continued.With these measures,the

majority of appendiceal abscesses resolve satisfactorily,although many days of hospitalization is required.(25)

An interval appendicectomy 6 weeks to 3 months later is strongly advised,since the recurrence rate is very high.(36)

PREOPERATIVE PREPARATION

It is not necessary to rush a patient with a presumed diagnosis of acute appendicitis directly to the operating room. All patients, especially those with a presumed diagnosis of peritonitis, should be adequately prepared before being taken to the operating room.

Selected patients with a palpable right lower quadrant mass may be initially managed without operation.

Intravenous fluid replacement should be initiated and the patient resuscitated as rapidly as possible, especially when peritonitis is suspected. Once the patient has a good urinary output, it can be assumed that resuscitation is complete.

Nasogastric suction is especially helpful in patients with peritonitis and profound ileus.

If the patient's body temperature is higher than 39° C, appropriate measures should be taken to reduce fever prior to beginning of an operation.

A broad-spectrum antibiotic, should be administered preoperatively to help control sepsis and to reduce the incidence of postoperative wound infections. If, at the time of operation, the patient has early appendicitis, antibiotic administration can be stopped after one postoperative dose.

Antibiotics should be continued as clinically indicated in patients who have gangrenous or ruptured appendicitis with localized or generalized peritonitis.

EXAMINATION UNDER ANESTHESIA

After the induction of anesthesia, the patient's abdomen should be systematically palpated. Such an examination may, on occasion, demonstrate another pathologic condition to be the cause of the patient's symptoms, such as acute cholecystitis.

It also may be possible to palpate an appendiceal mass that will confirm the suspected diagnosis.

Uncomplicated Appendicitis Without a Palpable Mass

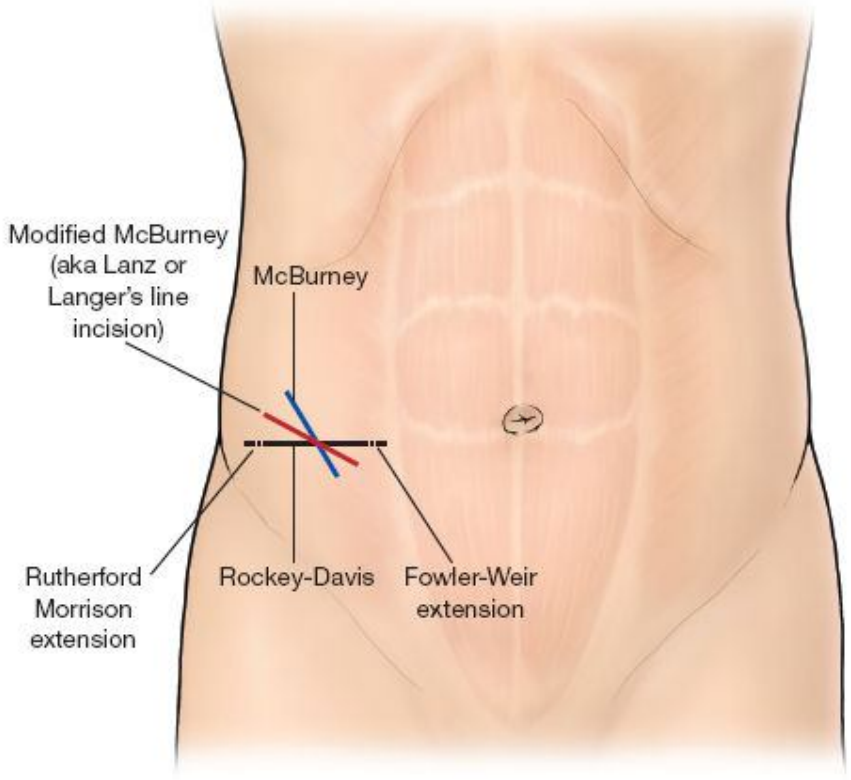
In this circumstance, when the diagnosis of acute appendicitis has been made and there is no reason to suspect that the appendix has ruptured, an appendectomy should be performed.

The earlier the diagnosis is made and the sooner the appendectomy is performed, the better the prognosis. As stated earlier, if there is any doubt about whether the appendix has ruptured, the operation should be performed at once, because the morbidity of a perforated appendix is 100-fold greater than that of an uncomplicated appendectomy.

The latter procedure should have a surgical mortality rate of less than 0.1%, whereas in contrast, the mortality rate of a ruptured appendix can be as high as 10%.

One recommended incision for a routine appendectomy is a transverse one (i.e., Rockey-Davis, Fowler-Weir-Mitchell incisions). The incision is made in a transverse direction, 1 to 3 cm below the umbilicus, and is centered on the midclavicular

line. The length of the incision should be approximately 1 cm longer than the breadth of the surgeon's hand.



The aponeurosis and muscles of the abdominal wall are split or incised in the direction of their fibers . Exposure of the appendix through this incision is better when compared with that obtained through the classic McBurney incision, particularly in patients with a retrocecal appendix and in those who are obese.

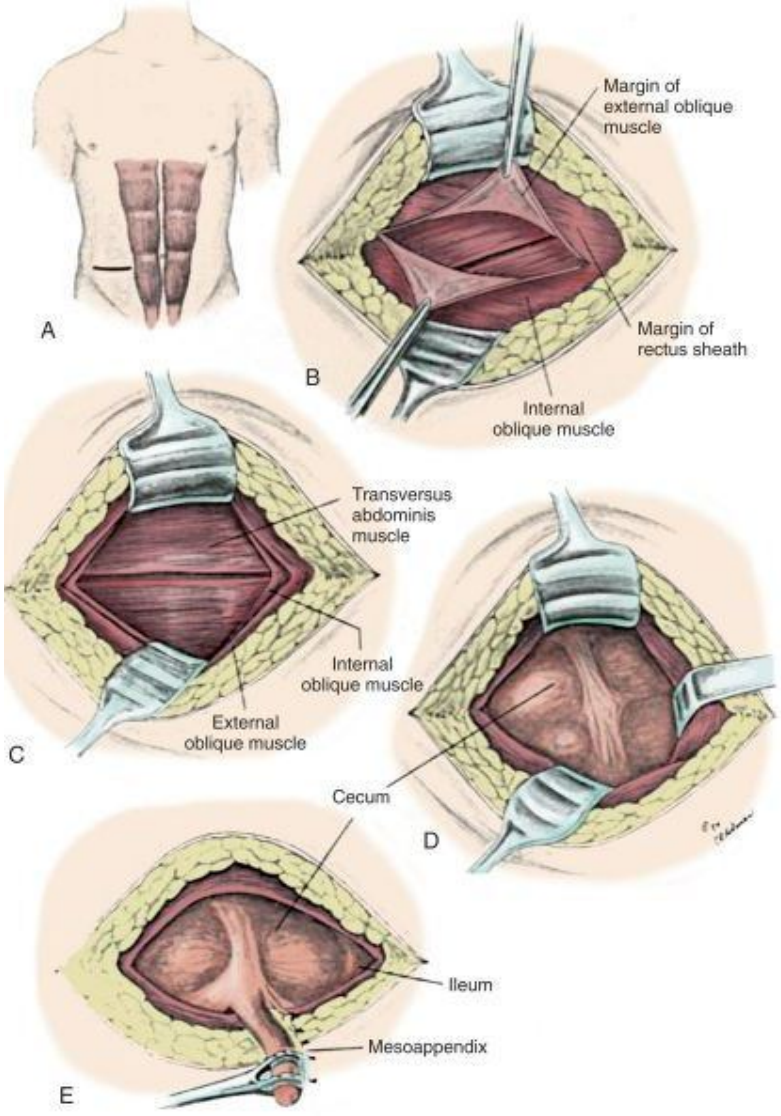


Figure-1 Steps in exposing the appendix for an appendectomy through a transverse incision. **A,** Placement of the skin incision. **B** and **C,** External and internal oblique and transversus abdominis muscles are divided in the direction of their fibers. **D,** After incision of the peritoneum, the cecum is exposed and the appendix is located by following the anterior cecal taenia inferiorly. **E,** The cecum

is mobilized into the wound through incision of its lateral peritoneal reflection

The other recommended incision, the gridiron, or muscle-splitting one (McBurney incision), can be used. This is the most widely used incision in uncomplicated appendicitis.

The skin incision is made through a point one third of the way along a line from the anterosuperior spine of the ileum to the umbilicus. The incision is made obliquely, beginning inferiorly and medially, and extending laterally and superiorly.

It should be 8 to 10 cm in length, with its most medial extent being the lateral edge of the rectus muscle. The aponeurosis and muscles of the abdominal wall are split or incised in the direction of their fibers in such a manner that the entire skin incision can be used for exposure.

After entering the peritoneum, the appendix is found as described for the transverse incision. The exposure through a McBurney incision, especially for a retrocecal appendix, can be

awkward unless the appendix lies immediately below the incision.

If necessary, the incision can be extended medially, partially transecting the rectus sheath, but this maneuver is usually helpful only in a pelvic appendicitis.

If there is doubt about the diagnosis of acute appendicitis and an exploratory laparotomy is indicated, a vertical midline incision is more appropriate. An appendectomy can be performed with little difficulty through such an incision.

After the peritoneum is opened, the appendix is identified by following the anterior cecal taenia to the base of the appendix. The inflamed appendix is coaxed into the wound by gentle traction and the transection of adhesions, if present.

If the appendix is retrocecal or retroperitoneal, or if the local inflammation and edema are intense, exposure is improved by dividing the lateral peritoneal reflection of the cecum. At the end of this maneuver, the cecum should lie within the wound and the appendix should be at the level of the anterior

abdominal wall so that continuing vigorous retraction is unnecessary while removing the appendix.

If the appendix is not adherent, its base can be easily identified because the entire appendix often pops into the operative field. If the appendix is adherent, however, its base may be difficult to recognize. Aids in recognition include the following:

1. All three taeniae lead to and end at the base of the appendix.
2. The ileocecal junction can usually be identified, just below which is the base of the appendix.

If the appendix does not come into the wound but the base has been identified, an Allis clamp can be placed around but not on the appendix for traction.

An effort is made to deliver the tip of the appendix into the operative field. If the appendix is not adherent to surrounding

tissues, traction on the Allis clamp is usually successful in delivering the appendix.

Once the appendix has been freed up, the mesoappendix is transected beginning at its free border, taking small bites of the mesoappendix between pairs of hemostats placed approximately 1 cm from and parallel to the appendix. This process should be repeated until the base of the appendix is reached.

If exposure of a long, adherent appendix is difficult, the mesoappendix can be transected in a retrograde manner beginning at the base of the appendix.

There are three ways to handle the appendiceal stump: simple ligation, inversion, and a combination of ligation and inversion. Either simple ligation or inversion is acceptable and has a comparable incidence of complications.

The combination of ligation and inversion is not recommended, because it does not reduce the risk of septic complications, but it does create conditions conducive to the development of an intramural abscess or mucocele.

Also, the ligated and inverted appendiceal stump may later appear on a subsequent BE as a cecal “tumor” and be a source of diagnostic difficulties. (26)

Simple ligature of the appendiceal stump is accomplished by crushing the appendix at its base with a hemostat, then moving the hemostat and replacing it on the appendix just distal to the crushed line.

A ligature of monofilament suture is placed in the groove caused by the crushing clamp and is tied tightly .The appendix is transected just proximal to the hemostat and removed.

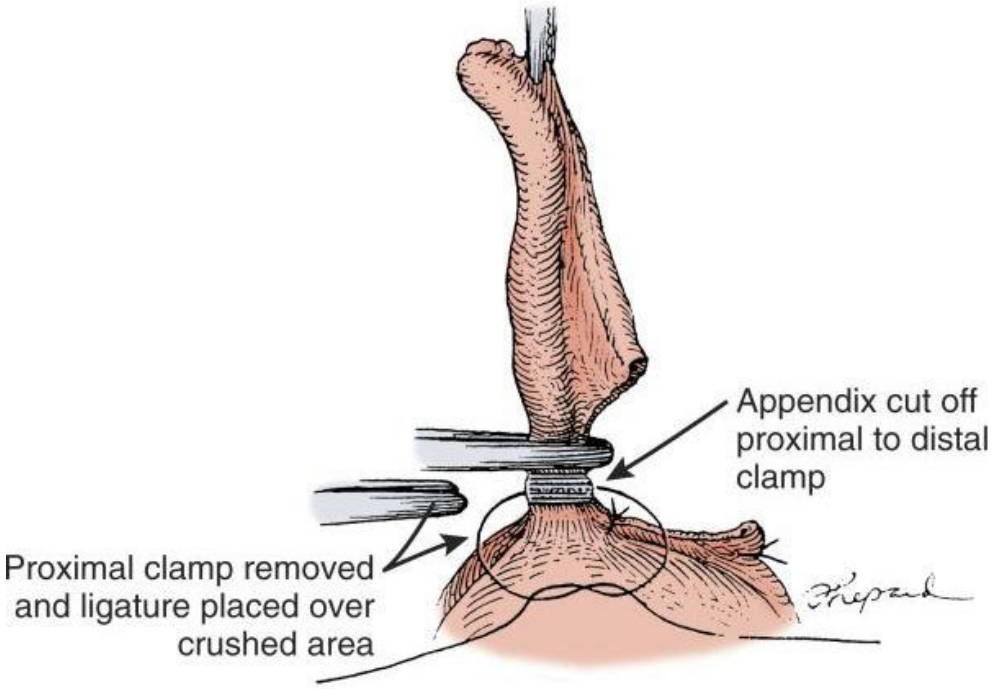


Figure-2 Ligation of the stump of the appendix in the groove formed by a crushing clamp.*(From Partipilo AV: Surgical Technique and Principles of Operative Surgery, 4th ed. Philadelphia, Lea & Febiger, 1949.)*

Inversion of an unligated stump using a Z-stitch, rather than the more conventional pursestring suture, is preferred. The upper level of the Z-stitch is placed as a Lembert suture in the cecum, just distal to the base of the appendix.

The suture is then brought around the base of the appendix and continued as a second Lembert suture beneath the base of the appendix.

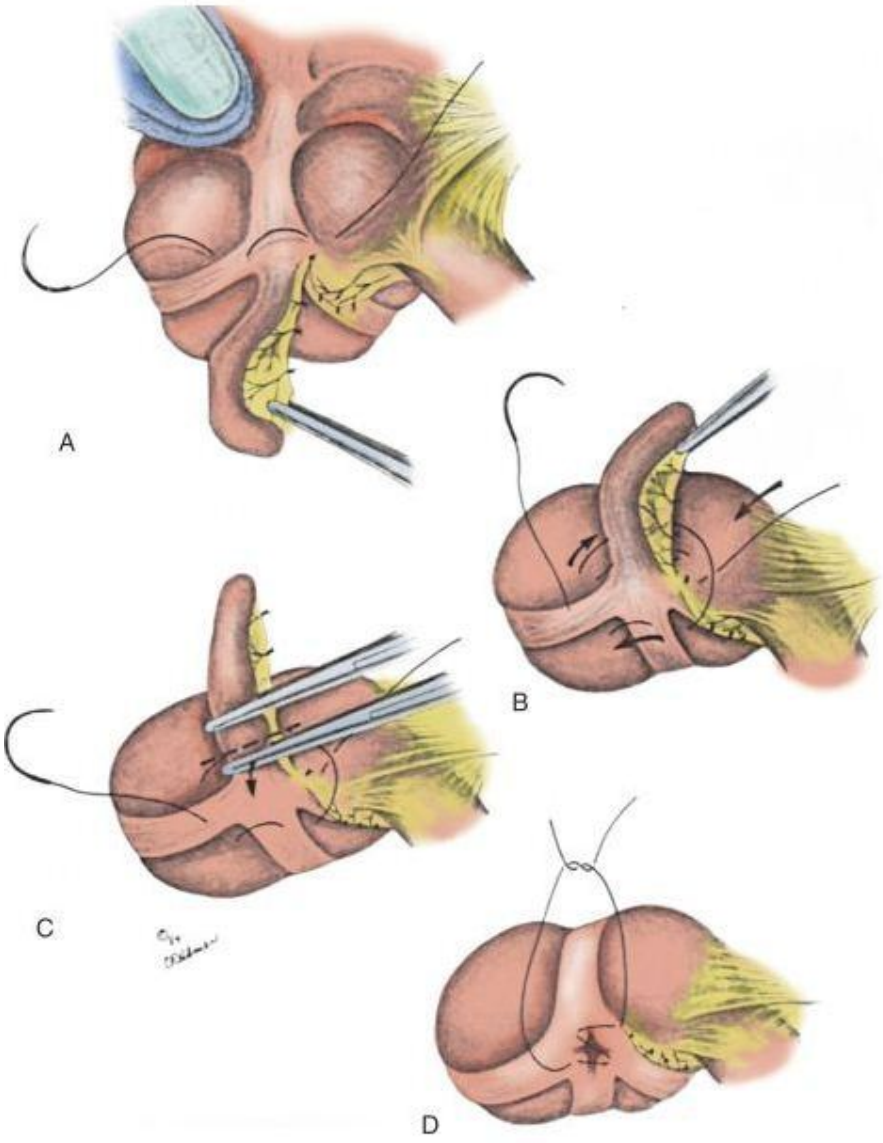


Figure-3 Use of a Z-stitch to invert the unligated appendiceal stump. **A,** Two bites of the suture are placed in the cecum 1 cm distal to the base of the appendix. **B,** The suture is then brought around the appendix medially and two additional bites are placed beneath the base of the appendix. **C,** The appendix is then transected. **D,** The stump of the appendix is inverted into the cecum and the clamp is removed as the

suture is tightened. *(**A-D,** From Adams JT: Z-stitch suture for inversion of the appendiceal stump. Surg Gynecol Obstet 127:1321, 1968.)*

The appendix is then transected between clamps, the stump is inverted into the cecum, the proximal clamp is removed, and the ends of the Z-stitch are tied over the stump of the appendix.

The appendiceal stump is not ligated. If the appendiceal stump is unsuitable for inversion because of edema, it should simply be ligated and not inverted.

Laparoscopic Appendectomy

Laparoscopic and minimal access surgery continues to expand in the field of general surgery, and diagnostic laparoscopy and laparoscopic appendectomy have become accepted procedures in many surgeons' practices.(27)

The early use of diagnostic laparoscopy in patients with right lower quadrant abdominal pain and suspected appendicitis

reduces the risk of appendiceal perforation and the negative appendectomy rate to less than 10%.(28)

Diagnostic laparoscopy is particularly useful in women of reproductive age and in the obese. In the former, frequently confounding gynecologic disorders can be well visualized to provide the diagnosis, and in the latter, laparoscopy can eliminate the morbidity risks of a large incision.(29)

In addition, it is safe to not proceed with appendectomy if the appendix appears normal.

Conversion of diagnostic laparoscopy to therapeutic laparoscopy is easily accomplished by the addition of other ports. Trocar placement for laparoscopic appendectomy is a matter of surgeon choice with consideration of the triangle rule for port placement.

Diagnostic laparoscopy is usually performed through a periumbilical port, with a 10/11-mm port added midway between the umbilicus and pubis and a 5-mm port placed over

the appendix or the right midlateral abdomen if appendectomy is performed.(30)

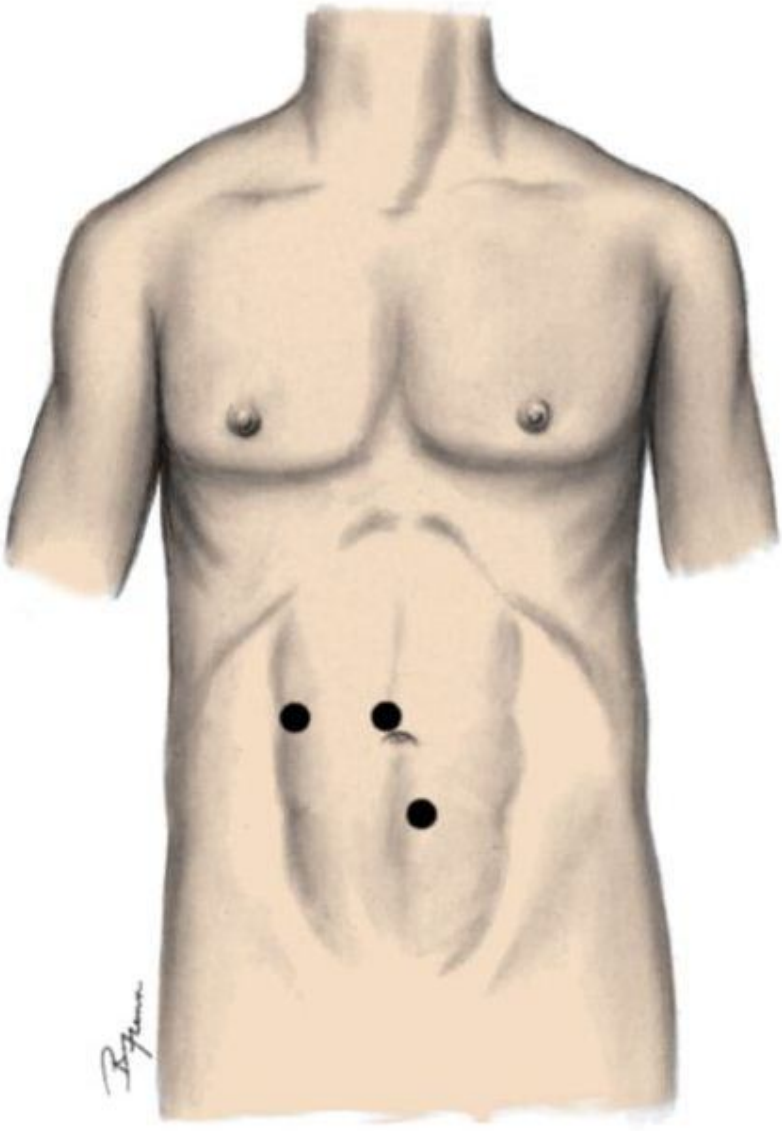


Figure-4 Trocar placement for laparoscopic appendectomy. Additional trocars can be placed in the right upper or left lower quadrants. *(From Frantzides CT: Laparoscopic and Thoracoscopic Surgery. St. Louis, Mosby–Year Book, 1994, p 66.)*

Once the diagnosis is confirmed, the mesoappendix can be taken down with either hemoclips or the harmonic scalpel. The appendix is amputated from the cecum between endoloops or with an endo-GIA stapler .

The appendix can then be removed from the abdomen with a specimen pouch or withdrawn into the 10/11-mm port. Care should be taken to prevent contact of the appendix or its contents with the wound edges.

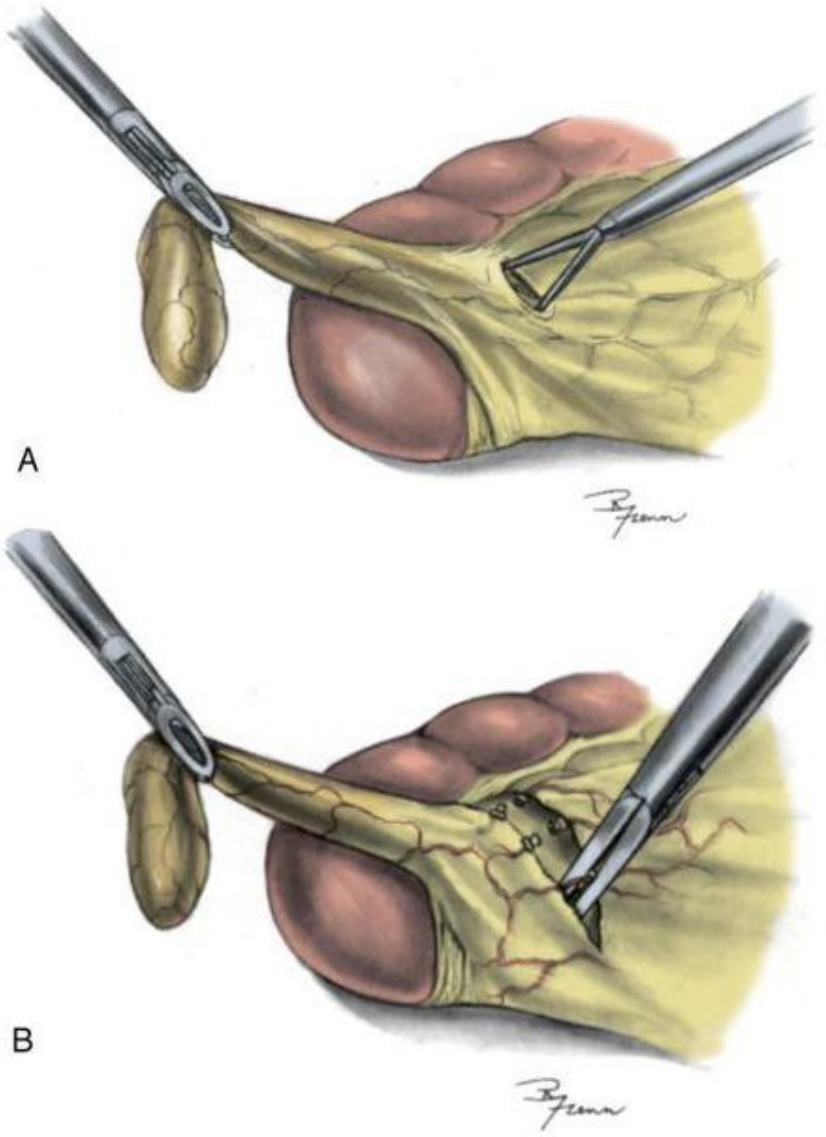


Figure-5 Technique for laparoscopic appendectomy. **A,** The appendix is grasped and retracted toward the pelvis, thus exposing the mesoappendix. **B,** The mesoappendix is divided using individually placed clips.*(**A** and **B,** From Frantzides CT: Laparoscopic and Thoracoscopic Surgery. St. Louis, Mosby–Year*

Book, 1994, p 67.)

There is general agreement that patients undergoing laparoscopic appendectomy have less postoperative pain, a lower rate of wound infection, a lower overall complication rate, a more rapid return to diet, a shorter hospital stay, a longer operative time, and more equipment charges in the operating room.

Laparoscopic appendectomy results in a lower wound infection rate compared with an open procedure but has a higher intra-abdominal abscess rate if the appendix is perforated.

Appendicitis with abscess should not be addressed laparoscopically because the pneumoperitoneum can disrupt the abscess cavity with soilage of the abdomen. Dissection of the abscess laparoscopically carries an undue risk of injury to the bowel and mesentery.

Other relative contraindications to laparoscopic appendectomy include previous abdominal surgery precluding

safe trocar placement, uncontrolled coagulopathy, and significant portal hypertension.

Laparoscopic appendectomy appears to be safe and efficacious. It provides a rapid diagnosis and a significant reduction in negative appendectomy rate in females of child-bearing age with suspected appendicitis. Minimal access surgery reduces the morbidly risk in obese patients who require an appendectomy.(31-35)

Perforated or Gangrenous Appendicitis with a Periappendiceal Mass

When a mass is detected by examination under anesthesia, a transverse incision is made over the most prominent portion of the mass

The muscles and aponeuroses are split along their lines of cleavage in gridiron fashion. After entering the peritoneal cavity, the wound should be packed immediately to prevent contamination of the abdominal cavity.

As mentioned earlier, the mass may be made up of omentum and loops of small intestine adherent to the inflamed appendix, and an abscess may not be present.

If feasible, an appendectomy is then performed; usually it will not be possible to invert the stump, so simple ligation is preferred.

It is not necessary to place a subfascial drain in a patient with a gangrenous appendix and minimal or no periappendiceal pus. If there is a periappendiceal abscess and the tissues are fixed so as to create a dead space, the cavity should be drained with one or more closed-suction drains brought out through a separate stab incision.

Before fascial closure, the right iliac fossa and the wound should be liberally irrigated. Muscles and aponeuroses should be closed with interrupted nonabsorbable sutures. The skin should be left open, to be closed with adhesive paper tapes on the 5th or 6th postoperative day. Parenteral antibiotics should be continued

for 5 days after operation or until clinical signs indicate no infection.

Perforated Appendicitis with Localized Abscess Formation

If, at the time of initial physical examination, a well localized periappendiceal mass is found and the patient's symptoms are improving, it is acceptable in healthy adults to initiate parenteral antibiotic treatment and to follow the patient expectantly.

This form of therapy is not appropriate in children, pregnant women, or elderly patients. In these groups, an emergency operation is indicated.

In two thirds of patients, expectant treatment of an appendiceal mass succeeds, and an interval appendectomy can be performed at a later date.

In one third of patients, symptoms do not subside and an emergency CT scan should be performed. If an abscess is identified on CT scan an attempt should be made to drain the

abscess percutaneously under CT or US guidance.If not successful, the abscess should be drained surgically.

The skin incision for drainage of a periappendiceal abscess is made just medial to the crest of the ilium at the level of the abscess. Using a muscle-splitting technique, the lateral edge of the peritoneum is exposed and pushed medially so that the abscess is approached from its lateral aspect.

Once the abscess is entered, a finger should be used to break up the loculations. If the appendix can be freed up without breaking down adhesions, an appendectomy should be performed.

If an appendectomy is not performed, an interval appendectomy can be done 3 to 6 months after drainage from the abscess has ceased and the wound has completely healed.

After the wound has been thoroughly irrigated with normal saline, a closed-suction drain should be inserted into the abscess cavity and brought out through a separate stab wound in the flank.

The muscles and aponeuroses are closed with interrupted nonabsorbable sutures, and the skin and subcutaneous tissues are packed open with saline-soaked gauze. The drain should be left in place until it is draining less than 50 ml/day and then advanced progressively until removed.

Systemic antibiotics should be continued for 5 days postoperatively or until signs of sepsis have cleared. A daily rectal examination should be done to detect pelvic abscess.

The patient may be discharged from the hospital when there is no fever 48 hours after the discontinuation of antibiotic therapy.

Perforated Appendicitis with Diffuse Peritonitis

The major cause of mortality from appendicitis is generalized peritonitis. Therefore, immediate exploration is indicated in a patient with a diagnosis of acute appendicitis in whom the physical findings are consistent with diffuse peritonitis.

If a perforated appendix and diffuse peritonitis are documented at operation, an appendectomy should be performed and the abdomen thoroughly irrigated.

The use of drains in diffuse peritonitis is not recommended unless there are localized abscesses requiring drainage. The wound and postoperative care should be handled as described in a patient with a periappendiceal abscess.

Normal Appendix When Appendicitis Is Suspected

If a patient undergoes exploratory laparotomy (especially through a right lower quadrant incision) for suspected acute appendicitis, and a normal appendix is subsequently found, a careful search for another pathologic condition should be made and an appendectomy performed.

The abdomen should not be closed until the cause of the symptoms has been identified and treated or the surgeon is sure that no lesion requiring treatment is present.

The normal appendix is *removed* to obviate diagnostic confusion in the future.

If the history and physical examination were appropriate for the diagnosis of acute appendicitis, it is not an error to perform an exploratory laparotomy and remove what appears to be a normal appendix.

A policy of early surgical intervention on the basis of clinical suspicion has been demonstrated overall to reduce both the morbidity and mortality of acute appendicitis.

In the past, a negative appendectomy rate of 20% was acceptable. Studies have suggested that rates of 10% to 15% and lower are feasible without an unacceptably high rate of perforated appendicitis.

Complications

Postoperative complications occur in 5% of patients with an unperforated appendix but in more than 30% of patients with a gangrenous or perforated appendix.

The most frequent complications after appendectomy are

- wound infection
- intra-abdominal abscess

- fecal fistula

- pylephlebitis

-intestinal obstruction.

Subcutaneous tissue infection is the most common complication after appendectomy. The organisms most frequently cultured are anaerobic *Bacteroides* species and the aerobes *Klebsiella, Enterobacter,* and *Escherichia coli.*

When early signs of wound infection (undue pain and edema) are present, the skin and subcutaneous tissue should be opened. The wound should be packed with saline-soaked gauze and reclosed with Steri-Strips in 4 to 5 days.

Pelvic, subphrenic, or other intra-abdominal abscesses occur in up to 20% of patients with a gangrenous or perforated appendicitis. They are accompanied by recurrent fever, malaise, and anorexia of insidious onset.

CT scanning is of great help in making the diagnosis of intra-abdominal abscess. When an abscess is diagnosed, it should be drained either operatively or percutaneously.

Some fecal fistulas close spontaneously, provided that there is no anatomic reason for the fistula remaining open. Those that do not close spontaneously obviously require operation.

Pylephlebitis, or portal pyemia, is characterized by jaundice, chills, and high fever. It is a serious illness that frequently leads to multiple liver abscesses.The infecting organism is usually *E. coli.* This complication has become rare with the routine use of antibiotics in complicated appendicitis.

Although not frequent, true mechanical bowel obstruction may occur as a complication of acute appendicitis. As with any other mechanical small bowel obstruction, operative therapy is indicated.

AIMS & OBJECTIVES

- To know the outcome of single dose antibiotic (cefaperazone sulbactam) in cases of emergency open uncomplicated appendectomy.
- To compare single dose (cefaperazone sulbactam) with multiple doses of antibiotics in case of emergency open uncomplicated appendectomy.

MATERIALS AND METHODS

- **DURATION:** JAN 15th 2014 TO SEP 15th 2014
- **STUDY DESIGN:**Prospective study
- **SAMPLE SIZE :** 150

INCLUSION CRITERIA:

- Patients presenting with clinical features suggesting of acute appendicitis - anorexia,right iliac fossa pain,nausea,vomiting and fever are included in the study.

EXCLUSION CRITERIA:

Patients with perforated appendicitis,appendicular abscess, appendicular mass formation

METHODOLOGY

Patients presenting with clinical features suggesting of acute appendicitis- anorexia, right iliac fossa pain, nausea, vomiting and fever admitted in emergency department of our hospital from the above mentioned period will be enrolled in our study.

Before performing an emergency open appendicectomy, the patients were randomized into two groups . Group 1 received single dose of cefaperazone sulbactam 1.5gm i.v. at time of induction of anaesthesia. In group 2, two further doses of cefaperazone sulbactam were given intravenously 12 th hourly for 3 days. Appendicectomy was carried out in all the patients by the standard protocol of open surgical technique. The surgical wound was closed in layers.

During the post-operative period, the progress of the surgical wound was monitored on a daily basis for all the patients included in the study. Wound infection was graded using the Southampton scoring system.

SOUTHAMPTON SCORING SYSTEM

GRADE	APPEARANCE OF WOUND
0	Normal healing
1	Normal healing with mild bruising
2	Erythema
3	Clear discharge
4	Purulent discharge
5	Deep wound infection

Wound healing was taken as normal for grades 0, 1 and 2. Infection of the wound was categorised as minimal for grade 3 and as major for grades 4 and 5. Patients who developed major infection were treated appropriately with daily wound irrigation and antibiotics based on culture reports.

Informed consent was obtained from all the patients and the study was carried out with prior clearance from the ethical committee.

STUDY PARAMETERS:

- Demographic data –age and sex
- Age wise distribution of infected/non infected in Test(group 1) and Control(group 2) cases
- Grade of wound infection
- Length of hospital stay

Observations are tabulated and the results are analyzed using Microsoft Excel for tabular transformation and graphical representation. For comparing the parameters and statistical analysis, 2-sample z-test are used.

OBSERVATION AND RESULTS

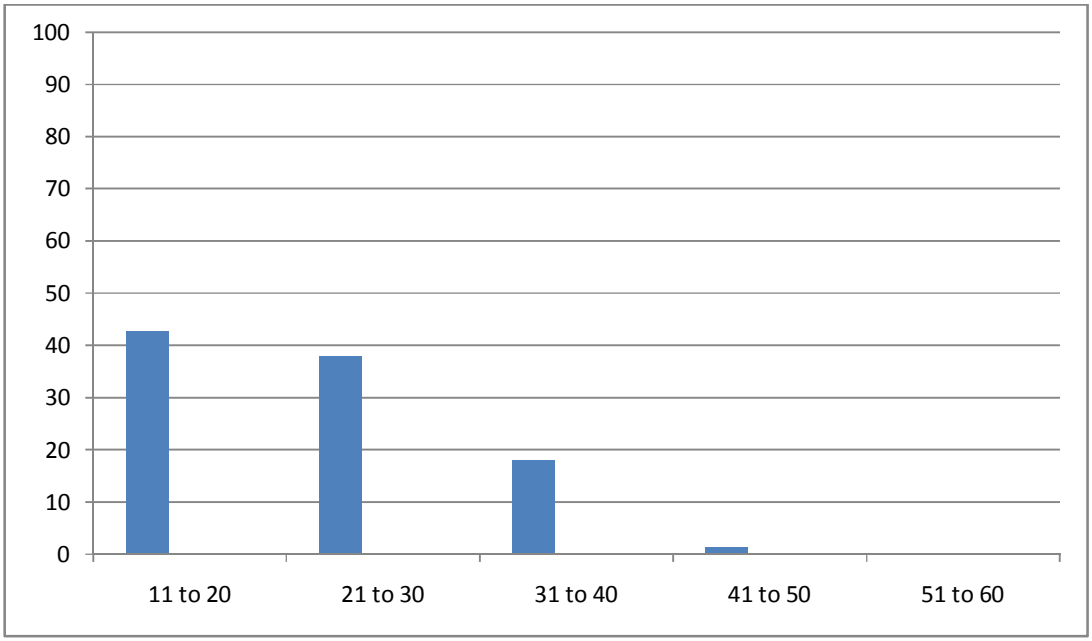
In our study, 150 patients were included with a diagnosis of acute appendicitis and randomized to two groups, with seventy five patients in each group.

The age group varied from 11 to 45 years in bothgroups, with a mean age of 20.9 years in group 1 and 24.1 years in group 2

Table 1- Age wise Distribution

Age Group	Number of Cases	Percentage(%)
11-20	64	42.67
21-30	57	38
31-40	27	18
41-50	2	1.33
51-60	**Nil**	**Nil**

Figure 1 - Age wise Distribution in Percent

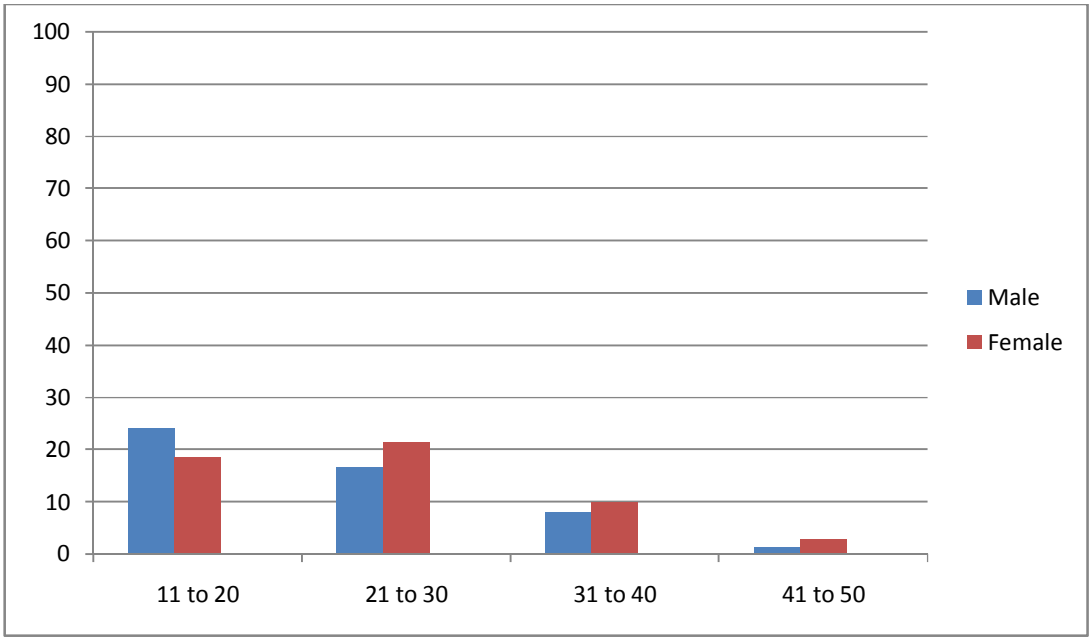


In the study, total of 75 patients were male and 75 were female with the age group in 2nd and 3rd decade being the most number of cases

Table 2 – Sex wise Distribution

Age Group	Male	%	Female	%
11-20	36	24	28	18.67
21-30	25	16.67	32	21.33
31-40	12	8	15	10
41-50	2	1.33		

Figure 2- Sex wise Distribution in Percent

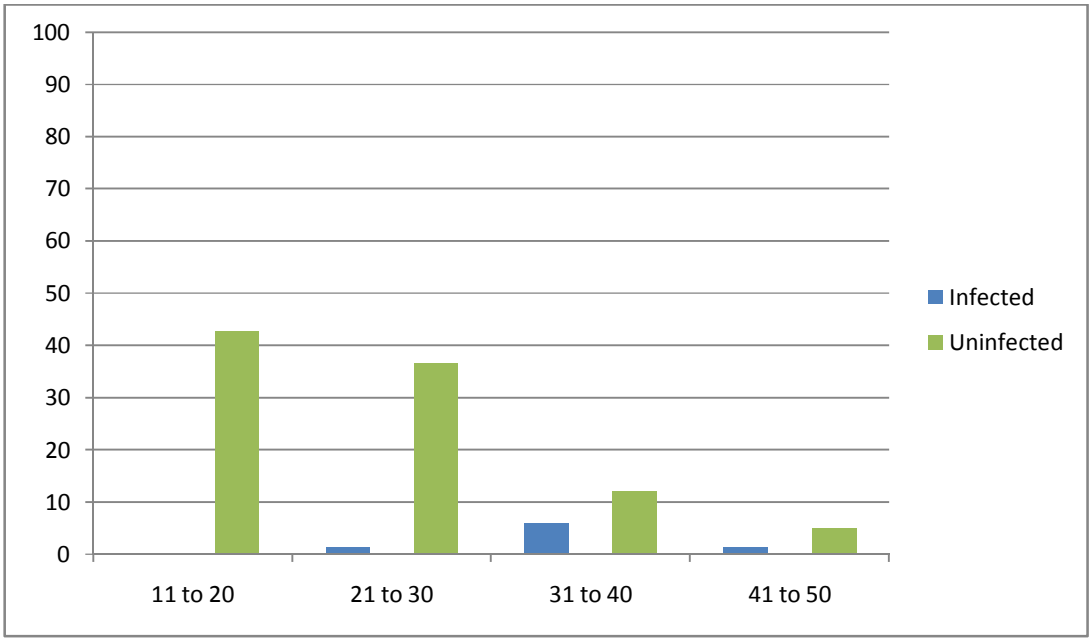


The total number of cases who developed post-operative infection is 13 with the peak incidence of infection being in the 4^{th} decade of life.

Table 3- Age wise Distribution of Infection

Age Group	Total No. of cases	No. of cases Infected	Percentage
11-20	64	Nil	0
21-30	57	2	1.33
31-40	27	9	6
41-50	2	2	1.33
51-60	Nil	Nil	
Total	150	13	8.66

Figure 3 – Age wise Distribution of Infection in Percent



Of the 13 cases who developed infection post-operatively 7(9.33%) of them belonged to the study group and 6(8%) of them belonged to control group

Table 4 – Distribution of Infected cases in Test and Control Group

	Test Group	**Control Group**
Total No.Of Cases	75	75
No.of cases Infected	7	6
Infection Rate	9.33%	8%

Figure 4- Infection Rate

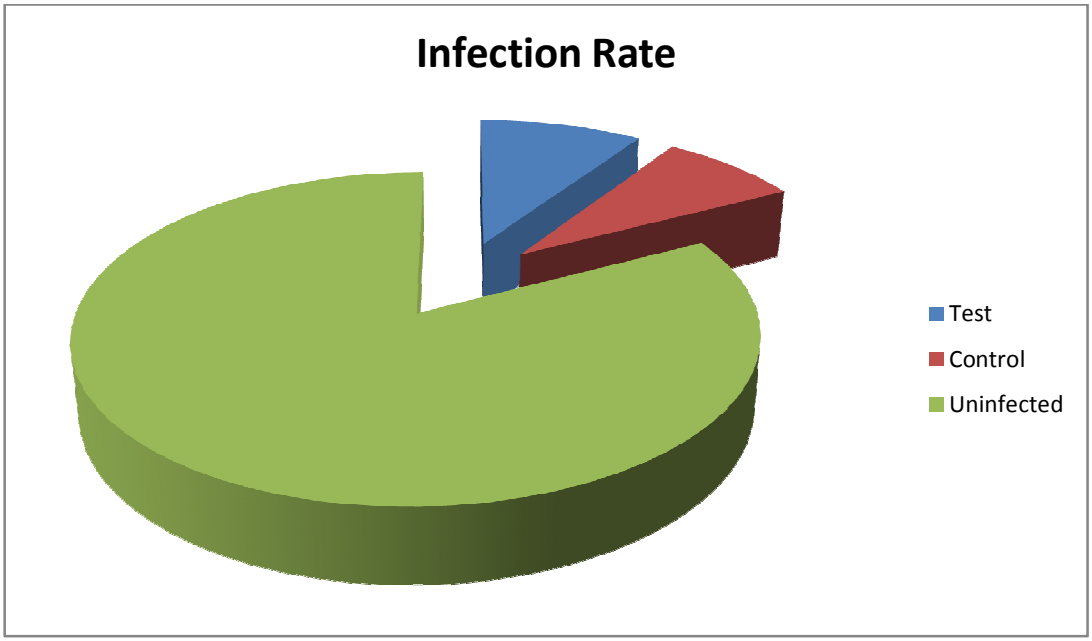


Figure 5 – Distribution of Infection

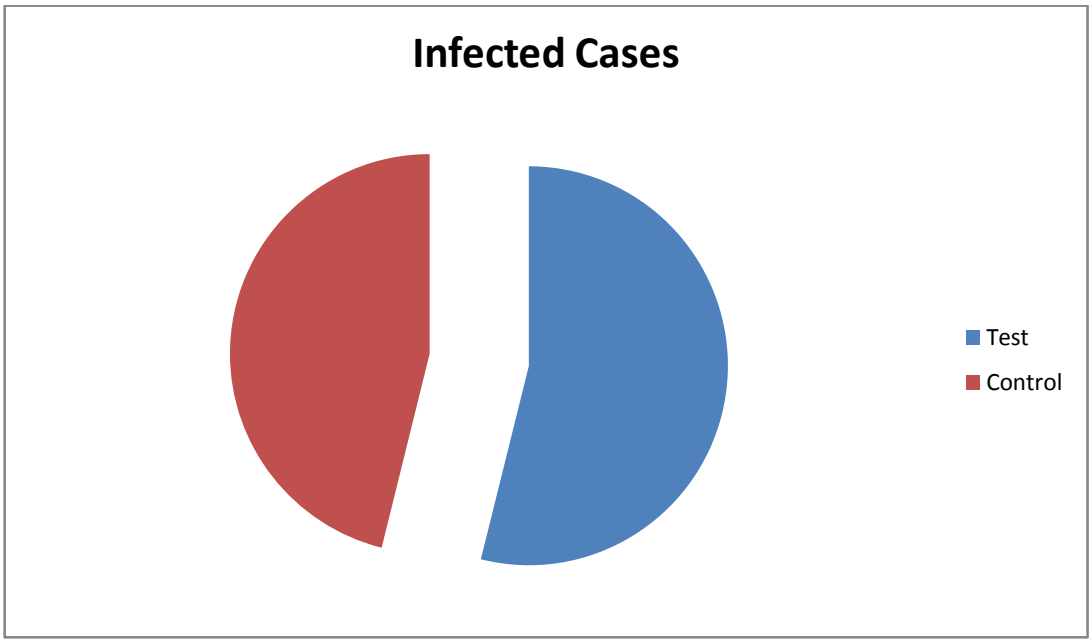


Table 5- Median Hospital Stay

Test Group	Control Group
5 days	5 days

Test of statistical significance

2-sample z-test to compare sample proportion

Comparing two sample proportions using the 2-sample z-test. P-values can be calculated for one- or two-tailed comparisons and are compared results to a specified significance level

Inputs

	Sample 1	Sample 2
Sample Proportion	0.09	0.08
Sample size	75	75
Significance level	0.05	
1- or 2-tailed test	1-tailed	

Results

	Sample 1	Sample 2	Difference
Sample proportion	0.09	0.08	0.01
95% CI (asymptotic)	0.0356 - 0.1444	0.0285 - 0.1315	-0.0649 - 0.0849
z-value	0.2		
P-value	0.4131		
Interpretation	**Not significant**, accept null hypothesis that sample proportions are equal		
n by pi	n * pi >5, test ok		

SUMMARY

In the postoperative period, the surgical wounds were examined and graded using the Southampton scoring system.

- In the study, total of 75 patients were male and 75 were female with the age group in 2nd and 3rd decade being the most number of cases
- The total number of cases who developed post-operative infection is 13 with the peak incidence of infection being in the 4th decade of life.
- Of the 13 cases who developed infection post-operatively 7(9.33%) of them belonged to the study group and 6(8%) of them belonged to control group
- Normal wound healing was observed in 63(84%) patients in group 1 and 64(85.3%) in the other group.
- Minimal wound infection which resolved spontaneously was present in 5 out of 75 patients (6.6%) in group 1 and 5 of 75 (6.6%) patients belonging to group 2.

- Discharge of pus (grade 4) was observed in 7(9.3%) patients in group 1 and 6(8%) in group 2.
- No patients in either group developed grade 5 wound infection.

Using 2 sample z-test for analysis, the incidence pattern and the grade of wound infections in both the study groups were found statistically not significant.There was no significant difference in length of hospital stay between the two groups.

DISCUSSION

Usage of appropriate antibiotics is well known to control wound infection rates following open appendicectomy for uncomplicated acute appendicitis. While antibiotic prophylaxis is common in surgical procedures, inappropriate use of antibiotics occurs in 25–50% of general elective surgeries. A Cochrane systematic review found that antibiotic use in patients having uncomplicated appendicitis was superior to placebo in reducing the rates of postoperative complications but concluded that no recommendations can be made regarding the duration of antibiotic use. At the same time, in patients with severe form of appendicitis, it has advised to continue a comprehensive antibiotic regime, as the risk of infective complications is quite high in this group

The choice of antibiotic for prophylaxis varies widely in different centres and even among the different surgical units attached to the same Institute. The American Society of Health System Pharmacists (ASHP) recommends cephalosporins as

drug of choice for prophylaxis for nonperforated appendicitis and gentamicin with metronidazole only in cases of penicillin allergy . The major controversy lies in the optimum duration of prophylaxis in cases of acute nonperforated appendicitis. Many studies have shown that single preoperative dose of antibiotic is as effective as multiple postoperative doses in preventing wound complications following
appendicectomy.

A randomized control study by Mui et al have shown that single dose of preoperative antibiotic is adequate for prevention of infective complications of the wound in patients undergoing surgery for uncomplicated appendicitis. Their conclusion was that the prolonged antibiotic administration was cost-ineffective and led to unnecessary complications.

In our study,we have used a more objective method to assess the progress of the surgical wounds by correlating with the Southampton scoring system.There was no significant difference between wound infection rates of the single dose

group(9.3%) and the multiple dose group(8%).These findings are in full agreement to the similar studies in the literature.

Moreover,comparing the incidence of wound infection across all the grades in both the groups has shown no significant difference between the two groups.Cefaperazone sulbactam was chosen in our study as it was amongst available cephalosporins which has very good antibacterial spectrum for pathogens(Escherichia coli and Bacteriodes fragilis) causing post appendicectomy sepsis. This choice of antibiotic is in line with the recommendations given by the ASHP. We also found from our study that there was no significant difference in the length of the hospital stay between the two groups. Many studies have highlighted and repeatedly emphasised the effects of improper choice and inappropriately prolonged duration of prophylactic antibiotics on the rising emergence of antimicrobial resistance among the common pathogens. Coakley et al, in a recent study, have consistently proven that postoperative antibiotic treatment for nonperforated appendicitis did not

reduce infectious complications. In fact, their study showed significantly increased rate of adverse effects like Clostridium difficile infection, diarrhea, longer length of hospital stay and higher treatment cost. Patients receiving postoperative antibiotics were also more frequently readmitted and reoperated.

A possible benefit that can be derived from our study is that by using a single preoperative dose, the surgeon can be certain of having given an effective prophylaxis at induction of anaesthesia without the need to monitor further postoperative doses. Moreover, avoiding further intravenous doses of antibiotics may lead to savings in terms of nursing effort, time and the cost of treatment.

CONCLUSION

It is evident that prophylactic multiple doses of Cefaperazone sulbactam postoperatively confer no additional benefit over a single preoperative dose of Cefaperazone sulbactam. With additional benefits of the greater ease of administration and decreased cost, single dose Cefaperazone sulbactam is the prophylaxis of choice for appendicectomy in patients with nonperforated appendicitis in our study. It is essential for Surgeons and Surgical departments to update their routine practice of antibiotic prophylaxis to comply with updated guidelines and evidence base so as to avoid overuse of antibiotics and their multiple dosage schedule in order to prevent the emerging menace of drug resistance as well prevent the side effects in patient's perspective.

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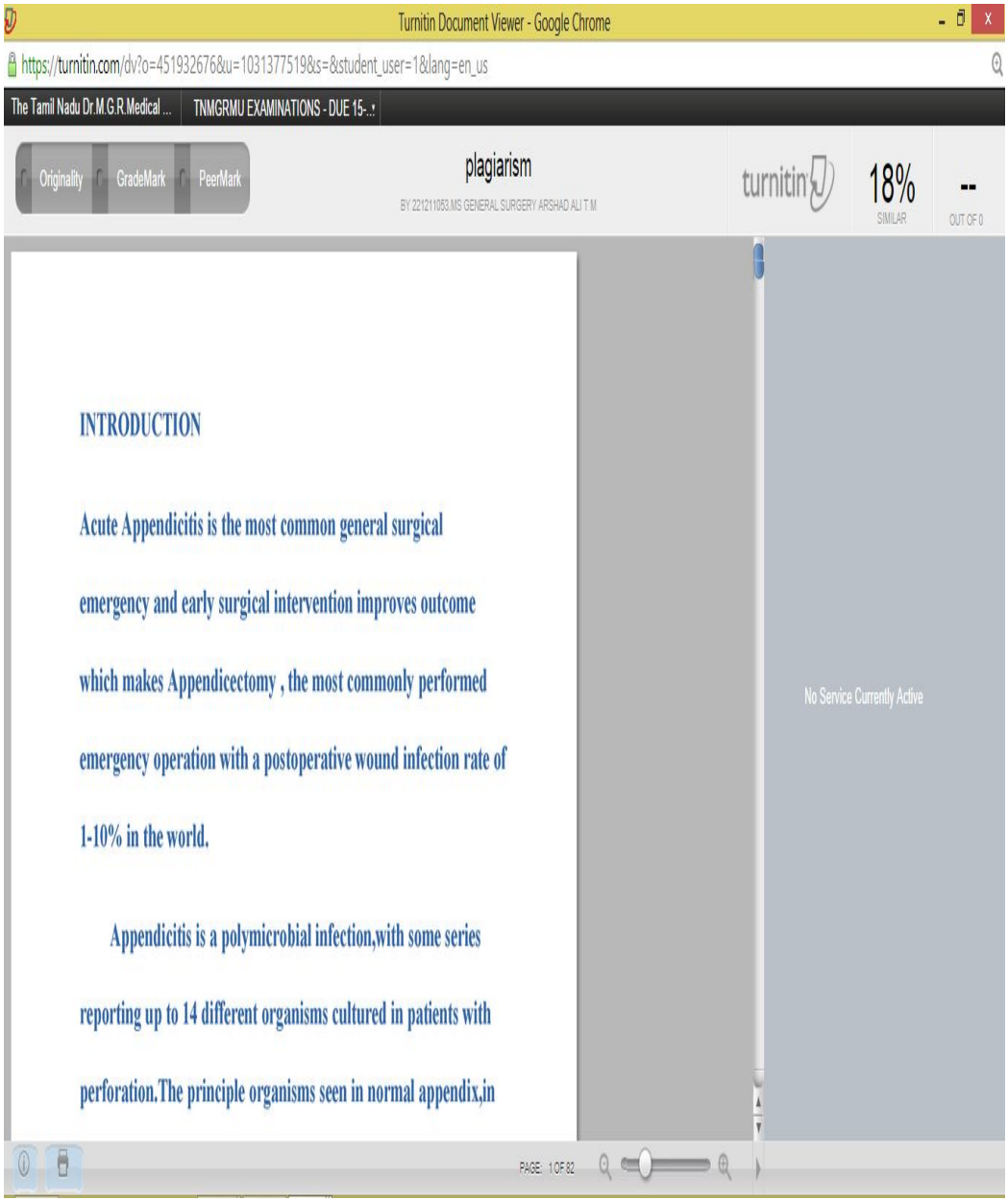
ANNEXURES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INTRODUCTION
Acute Appendicitis is the most common general surgical emergency and early surgical intervention improves outcome which makes Appendicectomy , the most commonly performed emergency operation with a postoperative wound infection rate of 1-10% in the world.
Appendicitis is a polymicrobial infection,with some series reporting up to 14 different organisms cultured in patients with perforation.The principle organisms seen in normal appendix,in
No Service Currently Active
PAGE: 1 OF 82

INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Comparison of antibiotic usage – third generation Cephalosporin single dosage Vs multiple dosage in case of emergency open uncomplicated appendicectomy

Principal Investigator : Dr.T.M.Arshad Ali

Designation : PG in M.S (Gen Sur)

Department : Department of General Surgery
Government Stanley Medical College,
Chennai-10

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 10.01.2014 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

7/2/14

MEMBER SECRETARY,
IEC, SMC, CHENNAI

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7/2/14

MEMBER SECRETARY,
IEC, SMC, CHENNAI

PROFORMA

SL. NO:

- **NAME :** **AGE /SEX:** **IP NO:**
- **ADDRESS WITH CONTACT NUMBER:**

- **DATE OF ADMISSION:** **DATE OF DISCHARGE/ DEATH:**

HISTORY OF PRESENTING ILLNESS:

H/O abdomen pain onset

Progression

Radiating

Aggravating/relieving factors

H/O vomiting

Nature of vomitus

No. of episodes

Associated with hemetemesis

H/O abd.distension, fever, jaundice

PAST HISTORY:

Whether a known case of DM/hypertension/asthma/TB/epilepsy/cardiac illness

H/o similar episodes in the past, if any:

H/o major illness/ hospital admissions, if any

PERSONAL HISTORY:

Whether a smoker or an alcoholic

FAMILY HISTORY:

TREATMENT HISTORY:

CLINICAL EXAMINATION:

General examination:

Systemic examination:

CVS

RS

CNS

Per abdomen

Clinical diagnosis:

INVESTIGATIONS:

CBC:

RFT:

URINE ROUTINE:

CHEST X-RAY:

ABDOMEN X-RAY:

ECG:

USG ABDOMEN:

FINAL DIAGNOSIS:

GOVT.STANLEY MEDICAL COLLEGE, CHENNAI- 600 001

INFORMED CONSENT

DISSERTATION TOPIC: ***COMPARISON OF ANTIBIOTIC USAGE-THIRD GENERATION CEPHALOSPORIN SINGLE DOSAGE Vs MULTIPLE DOSAGE IN CASE OF EMERGENCY OPEN UNCOMPLICATED APPENDICECTOMY***

PLACE OF STUDY: GOVT. STANLEY MEDICAL COLLEGE, CHENNAI

NAME AND ADDRESS OF PATIENT:

I, _____ have been informed about the details of the study in my own language.

I have completely understood the details of the study.

I am aware of the possible risks and benefits, while taking part in the study.

I understand that I can withdraw from the study at any point of time and even then, I will continue to receive the medical treatment as usual.
I understand that I will not get any payment for taking part in this study.

I will not object if the results of this study are getting published in any medical journal, provided my personal identity is not revealed.

I know what I am supposed to do by taking part in this study and I assure that I would extend my full co-operation for this study.

Name and Address of the Volunteer:

Signature/Thumb impression of the Volunteer

Date:

Witnesses:
(Signature, Name & Address)
Date:

Name and signature of investigator: